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THE NATURE OF WORD-ACCENT IN ENGLISH
WITH SPECIAL REFERENCE
TO DURATION AND PERCEPTION

by

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VOLUME 1

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ABSTRACT.

This is mainly a study of accent-based durational differences in syllables in British English. A framework for the study of accent is described. It is characterized by considering the two often separated domains (i.e. one-word utterances and longer utterances) as a single domain.

The durational manifestations of the different degrees of accent are then studied. The method adopted is that of comparisons of the durations of syllables with identical syntagmatic and paradigmatic structures, with the average margins of difference being assessed in terms of significance against a reference duration of 40 msec. The condition of identity in syntagmatic and paradigmatic structures is sometimes abandoned, however, for the sake of widening the scope of the material analysed or studying factors modulating the accent-duration relationship (e.g. speech-rate). The factor of syllable-position is occasionally used as a variable that affects this relationship.

The hierarchy proposed for accentual degrees is found to be consistently manifested by duration in a directly proportional relation unless other variables are operative. On the basis of syllable-durations, the dissociation of so-called "word-accent" and "sentence-accent" has been found to be implausible. Comparisons of the durations of syllable-tokens in one-word and longer utterances have been found to produce significant durational variations only when one of two factors is involved: final lengthening, and the change from primary tonic to primary non-tonic accent and vice versa. Both factors are known to operate in both domains. The results of various Tests confirm on the basis of syllable-durations

the inconsistency in the marking of secondary accents in the English Pronouncing Dictionary (EPD). It is proposed that further studies of other parameters in relation to accent would find it worthwhile to keep the syntagmatic and paradigmatic structures of syllables constant.

Various tenets and theories in the field of perception are then reviewed with respect to accent in the light of the results of a Perception Test. The results of the three Groups of judging informants (i.e. native linguists, native and phonetically naive, and non-native) were found to bear positively on the motor theory of speech perception. Familiarity with linguistic concepts was also found to be one of the factors that positively induced correct judgements. The advantage of native speakers of English over non-native ones was found to be maintained both in terms of the average percentage of correct judgement and of the patterns of incorrect judgement (e.g. opting for another prominent syllable in the word or for a non-prominent one). The deviation of the scores of correct judgements and the patterns of incorrect judgements in the case of given types of word (e.g. deliberately misaccented words and compound words) from the general percentages and patterns were also individually accounted for.

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Chapter I

Introduction

This Chapter has two underlying aims:

- (1) To review the literature on the nature of word-accent and related concepts;
- (2) To describe the framework adopted by the thesis in this respect; the framework that determines the way of interpretation offered for the experimental data in Chapters II and III.

These two aims are the subject-matter of Sections 2 and 3 respectively. They exist side by side in Sections 4 and 5. Section 4 throws some light on the various functions of accent with regard to facilitating speech production in general, helping in the semantic and lexical processing of speech and giving individual languages their characteristic patterns of rhythm. Section 5 discusses the nature of each of the four accent-determining factors (i.e. physiological stress, pitch, quality and duration), the interrelationships among them and their roles across the accentual hierarchy.

Section 1, however, attempts to provide a layman's impression of accent. Besides, it briefly considers the nature of the layman's awareness of accent in more linguistic terms.

Related to "accent" is a more common term (at least according to our bibliography), namely "stress". The use of the term "stress" ranges from a very well-defined and quantified phenomenon in such sciences as physics and engineering to a figurative word meaning to affirm certain statements or to put them strongly. In engineering, the term "stress" is used to indicate the amount of "force per unit area" (e.g. Wang 1953:1, and Williams 1973:4), taking into account of course all relevant factors like, for instance, the nature of the object being subjected to stress (e.g. solid vs liquid).

The term "stress" came into linguistics in general and phonetics in particular to denote the strength with which given stretches of speech (i.e. words or smaller units constituting words) are uttered. The Oxford English Dictionary (OED) traces this instance of usage of the word "stress" back to 1749. To quote:

"Stress... 8. Relative loudness or force of vocal utterance; a greater degree of vocal force characterizing one part of a word as compared with the rest; stress-accent. Also, superior loudness of voice as a means of emphasizing one or more of the words of a sentence more than the rest."
(1933:1111).

To realize what is meant by "a greater degree of vocal force", one can consider, for instance, the way a sentence like IAN WENT TO GLASGOW will normally be pronounced in these two cases:

1. As an answer to WHO WENT TO GLASGOW?
2. As an answer to WHERE DID IAN GO?

The words IAN and GLASGOW will be stressed in these two cases respectively. That is, they will be made to stand out relative to

the rest of the sentences constituting them.

The concept of "stress" or "accent" in sentences as explained in the preceding paragraph may not be so elusive for someone who happens to read or hear of it for the first time. That this phenomenon is also operative within a word of given length may be less noticeable. The reader, especially one who is a native speaker of English, is invited to say the following sets of words to himself/herself.

A. PHOTOGRAPH

PHOTOGRAPHY

PHOTOGRAPHIC

B. ALLERGY

ALLERGIC

C. SUBSTANCE

SUBSTANTIALLY

D. ELECTRIC

ELECTRICITY

Within each of these sets of derivationally related words the location of stress varies from one word in the set to another. If one takes the first word of Set A on its own, one may not realize still where that so-called stress is. But if one says the first and second words in that set one after the other, one will realize that there is a difference between the spoken form of either word. The #TO# in PHOTOGRAPHY is rather more prominent than its counterpart in PHOTOGRAPH. This prominence is due to the greater respiratory

effort the speaker gives to that part while uttering it. The sounds constituting that part may seem to be uttered with more deliberation and greater length than their counterparts in PHOTOGRAPH. One will notice as well that the <O> in #TO# in the word PHOTOGRAPHY is not identical in pronunciation to its counterpart in PHOTOGRAPH.

Whereas in the former it sounds like the <O> in TODDLER, in the latter it sounds like the <A> in ITALY. This type of sound change is sometimes an indispensable prerequisite for stress to be applied to a given part of the word.

To realize how important it is to keep the stress location within the word unchanged to maintain its identity, one could try the following simple procedure. Immediately after pronouncing the word PHOTOGRAPH one should not move to the next word in the set but rather imagine there is the letter <Y> that one has incidentally to carry on pronouncing without any pausing. Trying the same with sequences of words in each set, one would notice that the word ensuing in each case is not the spoken form for subsequent words.

To check for oneself how correct one's impressions about the location of stress in each word in the sets listed above, those sets are rewritten below in such a way as to show their component parts (linguistically called syllables) with the stressed syllable in each word underlined.

A. PHO TO GRAPH
PHO TO GRA PHY
PHO TO GRA PHIC

B. A LLER GY
A LLER GIC

C. SUB STANCE

SUB STAN TIA LLY

D. E LEC TRIC

E LEC TRI CITY

The underlying aim of our argument so far has been to get the layman to form an impression about what accent is. We consider now the nature of the layman's awareness of accent in more linguistic terms. It should be pointed out that the awareness of linguists with regard to the location of stress is a privilege to them as compared with laymen only consciously. Non-linguists are no doubt unconsciously aware of that when they use stress in their speech and when they respond to other people's use of it. Fromkin (1977) ascribes jokes like that about "putting the emPHAsis on the wrong sylLABle" to the awareness of English speakers and listeners of stress placement on given syllables and to their recognition that errors in stress placement represent a breach of norm. Cutler (1983a:91) studies speech errors that are corrected in the course of speech and the relation of the stress patterns of the corrections to those of the errors. She finds that errors in "lexical stress" placement occur when the speaker shifts the stress to a syllable that is stressed in a derivationally related word (e.g. sarCAsm because of its relation to sarCASTic). Analysing a corpus of speech errors in this respect, she concludes that the speaker makes corrections more often when s/he assesses that the listener would not be able to identify the target word, some sound change being involved. Where "full" vowels are replaced in the errors by

"reduced" vowels (see the Sub-section on Quality, page ff below) or vice versa, Cutler finds that 62% of stress placement errors are corrected by the speaker. Where no such change is involved, only 23% of errors are.

2. A Survey of the Use of the Terms "Accent" and "Stress".

It was not until the fifties of this century that some linguists (e.g. Bolinger 1958a) recommended the restriction of the term "accent" to a certain domain, namely that of the so-called sentence-stress, as distinct from the domain of word-stress, for which they retained the term "stress". Cutler and Ladd (1983) maintain that the previous thirty years have witnessed a turning point in the use of the terms "accent" and "stress". To quote them:

"Stress and accent have long been near-synonyms for prosodic features which render some syllables acoustically more prominent than others..../...

The term (pitch) accent is thus applied to languages like English rather more now than it was 30 years ago. Those who define prominence in actual utterances primarily in terms of pitch movement tend to reserve the term stress - or word stress, or lexical stress - for the lexical abstraction, and to use the term accent...or phonological prominence....for actual utterance prominences marked by pitch movements." (1983:141).

The categorization of accentual phenomena into "sentence-stress" and "word-stress", as argued in the next Section, is a questionable one. We have, therefore, to make clear from the very beginning how the terms "accent" and "stress" are being distinguished. We take the one to be a perceptual category, the other to be a production one. That is to say, accent is what acoustically characterizes

given syllables making them more prominent for the listener than others. Stress, on the other hand, is what the speaker does in terms of physiological effort to characterize such syllables for the listener (Gimson 1980:222). On this basis, we proceed to survey the different approaches to the use of the term "accent" since the late nineteenth century.

The pre-dissociation stage of the terms "accent" and "stress" presents some pioneering ideas. Sweet, the prominent late 19th century phonetician, makes no distinction between the two terms so that they are used interchangeably. Thus, defining stress he writes: "We have already defined stress (accent) as the comparative force with which the separate syllables of a sound-group are pronounced..." (1877:91)¹. Similarly, Jespersen writes: "Stress is generally believed to be dependent exclusively on the force with which the air-current is expelled from the lungs, hence the name of 'expiratory accent'..." (1922:271). These definitions, then, concentrate on the physiological attributes of stressed syllables. In the same vein, Scott (1939) uses the term stress reserving it for the physiological effort characteristic of given syllables.

One of Sweet's ingenious remarks on the distribution of stress is that it is not incremental. To quote him:

"...the tendency of stress is not like that of a single force impulse, to decrease progressively but rather to sway to and fro. Hence if we have a group of three syllables, the first of which has the predominant stress, we may generally infer that the second will be weaker than the third unless special modifications intervene " (1877:92).

1. We relied on Henderson's (ed.)(1971) book: The Indispensable Foundation: A Selection from the Writings of Henry Sweet for reference to Sweet's works.

This is in line with what is later extensively postulated by Berger (1955) and Arnold (1956/1957) about the alternation of stressed and unstressed syllables.

Muyskens (1931) uses the term "accent" and takes into account articulatory (i.e. "energetic consonant-movement") and acoustic/perceptual (i.e. "mostly longer duration and always higher pitch") manifestations of accent. Christophersen (1956:153) defines stress in such a way as to combine both articulatory and auditory attributes. He writes:

"When we say that a certain syllable is strongly stressed, we mean that it is uttered with great energy. The air is ejected from the lungs with more effort and the other speech organs perform their actions with more vigour, than for a weakly stressed syllable. The total effect is that the stressed syllable seems louder than the others."

Jones and Kingdon do not use the term "accent", but some of their types of stress correspond to the particular significance assigned to the term by other investigators. Kingdon (1958:ix) distinguishes two types of stress: "static stress" as a stress prominence unaided by pitch changes, these relying solely on "The force employed in uttering" it, and "kinetic stress" as a stress where this force is accompanied by a rapid change of pitch. Jones, as late as the ninth edition of his An Outline of English Phonetics (1960), distinguishes between stress as "...The degree of force with which a sound or syllable is uttered", (1960:245), and perceptual prominence as the outcome of physiological stress combined with inherent sonority, length and intonation. This distinction of Jones's indicates how stress phenomena pertain to the two planes of production and perception. Similarly, Katwijk (1972), using the term "stress",

refers to degrees of effort in production as corresponding to degrees of auditory prominence.

We can discern two approaches to prominence phenomena whether they are called stress or accent:

1. Accent as a collective feature for prominence phenomena:

This is not a detailed approach in the literature. We trace it back to a suggestion made by Berger (1955) that the term "stress" should be "reserved for the force of utterance (i.e. the physiological effort involved in that - our parenthesis) and that prominences of all kinds including stress be subsumed under the heading of Accent" (1955:376). This suggestion is further expanded to some extent by Gimson (1956, 1980:221-226) who lists stress, pitch, quality and quantity as factors capable of rendering a syllable more prominent than its neighbours. These factors have been indicated by other investigators (e.g. Sweet 1890:45-48; Ward 1945:156; and Jones 1960:247). An original feature of Berger and Gimson is their subsuming of "stress" (i.e. physiological effort) under "accent" as a cover term for prominence phenomena on the planes of both production and perception.

2. Accent as a context-determined feature:

This approach, established by Bolinger (cf. 1958a), deals with accent not merely as a syllable-based feature but rather as a type of pitch curve in long utterances (as distinct from one-word utterances), concentrating on the syllable carrying the nuclear tone

and plotting the pitch curve before and after it to establish the relation between the type of curve and the semantic content.

For Bolinger (1958a/1965a:17)¹, accents are not merely "added to the ups and downs of pitch" but are "embodied by them", hence his "theory of pitch-accent". He gives a new dimension to the concept of prominence when he rightly criticizes Jones's argument that stress is independent of pitch on the basis that "strong stresses are found on low-pitched syllables and weak stresses on high-pitched syllables." (1960:246). Bolinger maintains that in order to be a cue for accent, pitch need not rise only; prominence can be effected by either pitch rises or pitch falls as long as the rises or falls are put in focus. Accordingly, he defines prominence as "a rapid and relatively wide departure from a smooth or undulating contour" (1965:20).

In his quest for consistency with regard to his statements on the nature of accent, Bolinger claimed the abstractness of stress. That is, he suggested the restriction of the term "stress", which had commonly been associated with physiological and acoustic intensity, to the lexical plane and called it merely "a potential for accent". This view about stress as an abstraction has been widely shared ever since (cf. Lieberman 1970; Thompson 1980:15; Jassem and Gibbon 1980; and Bolinger 1986:14). Sharp (1960) even went as far as to argue that since the word is a grammatical abstraction, it has as such "no audible features: it exhibits for instance no attributes of stress of a kind that may be lost or modified in a sentence" (1960:108).

1. Page number references to Bolinger's 1958a, 1958c and 1961 articles are made according to their reappearance in his 1965 book: Forms of English: Accent, Morpheme, Order.

Newman (1946) held quite the opposite view. He writes:

In English every lexical, derivational and inflective element has stress characteristics as an essential part of its phonetic form" (1946:171-172).

Consequently, he adds:

"The word whether it is a unit word (e.g. bláck, còmpensátion) or a composite (bláckbird, òver-còmpensátion) may be defined as an element containing a heavy stress upon one of its syllables" (1946:174).

Bolinger's standpoint can be criticized on different bases as follows:

(1) He takes account only of variations in pitch disregarding the other properties of the accent-bearing syllable such as quality and physiological effort and relegates duration to a "residual" status. That is, he regards these properties as being there only dependently. Beckman (1986:60) puts it lucidly in these words: "From recognizing the importance in prominence of pitch obtrusion, Bolinger goes the further step of defining prominence as pitch obtrusion". She shows the importance of parameters other than pitch through summarizing the results of Nakatani and Aston (1978) as follows:

"Sentence—finally, where the test words had nuclear stress, the Fo pattern for the test words far outweighed the other parameters, as would be expected from earlier experiments such as those of Fry (1958). In prenuclear positions, however, duration and/spectral pattern (i.e., vowel quality) vied with Fo, sometimes ranking somewhat below and sometimes a little higher. And in postnuclear position, duration outranked Fo as highly as Fo outranked it in nuclear position. Given these results, it is difficult to agree with Bolinger's claim that duration is necessarily ancillary to pitch obtrusion in English." (Beckman 1986:61-62).

(2) Were prominence dependent on pitch change alone, it would

not be a sufficient means of distinguishing, say, one-word utterances of the disyllabic noun/verb pairs (e.g. INSULT) where pitch can be seen as acting in both ways: "stepping down" from a syllable to render it prominent, or "stepping down" to a syllable to render it prominent. The same can be said in the case of the verb form where pitch can be seen as "clipping up" to, or from a prominent syllable.

(3) In her detailed appraisal of Bolinger's pitch-accent theory, Beckman (1986:54-62) mentions another significant criticism, namely the fact that Bolinger "refused to abstract the accent patterns of words away from actual occurrences". That is, he entrusted the actual context of a word with the capability of unlimited options for shifting the stress. Though, one cannot, for instance, shift the stress to the second syllable of the word THIRTY to contrast it with the stressed second syllable of THIRTEEN.

The present study adopts the former approach which regards accent as a collective feature for prominence phenomena. That is, "accent" is used as a cover term for the perceptual/acoustic prominence of given syllables corresponding to the greater physiological effort distinguishing such syllables from others. For this greater physiological effort we reserve the term "stress". The need for this distinction is best put in these words of Beckman's (1986:55):

"...their [referring to accounts of stress/accent earlier than that of Bolinger 1958a - our parenthesis] account of stress as a category separate from intonation has some truth if understood as an attempt to separate the syntagmatic prominence relationships among parts of the utterance from such things as the choice of pitch shapes that can paradigmatically contrast different utterances having the same

organizational structure. Bolinger, on the other hand, denies that this distinction is possible. He reduces accent to its paradigmatic aspects, and denies that it can exist as a phonological property abstracted away from particular occurrences."

3. An Approach to Accent

For the purposes of this study, accent is defined as the collective feature for the physiological and acoustic factors of prominence that give the word its characteristic non-segmental pattern whether it constitutes an utterance on its own, or part of one, The accentual pattern of the word is abstractable out of the diversities of its occurrences making it possible for both speakers and listeners of the language to use and to identify it.

A question now poses itself: are the terms "accent" and "prominence" synonymous? The answer is in the negative for a greater value of prominence is not necessarily a greater value of accent. Like accent, prominence is multidimensional. It depends on the factors of stress, pitch, quality and quantity (see the Section on the factors of accent, page 36 ff). Unlike accent, it can be achieved by a change of speech tempo, or by a paralinguistic change of voice quality (e.g. from voiced into whispered speech). Prominence can be assigned not only to syllables but also to words and phrases as in the case of appositional phrases (see Test H below, page 126). Any of the factors cited above can achieve prominence, but when it comes to accent, a special combination of some of these factors is required. Stress as extra physiological effort is the non-optional factor for accent (or more precisely primary accent - see below how types of accent are being

distinguished, page 15 ff). Stress may be accompanied by either greater values or merely alterations of other factors (i.e. changes of pitch, longer duration, or promotions to full quality). In a word like EXERCISE, the third syllable can be perceived as considerably prominent on account of the inherent sonority of its vocalic nucleus, yet it cannot be said to be receiving a primary accent since it lacks the extra physiological effort. The first syllable of that word does receive that effort and is, therefore, said to be accented though its vocalic nucleus may be less sonorous than that of the third syllable. Thus, accent can be described as conditional prominence.

The factors of accent can be classified into segmental and non-segmental ones. Quality is a property of the segment. However, it is the quality of the syllabic sounds that affects accent. Stress, pitch and quantity, on the other hand, are non-segmentals; they affect the syllable as a whole. There are no clear-cut distinctions between the parts played by each of these factors in producing the effect of accent. That is, they are all interdependent.

We embark now on distinguishing the types of accent according to this suggested approach. We attempt in this respect to keep in mind the balance of stress and non-stress types of prominence that merge into accent. From what we have already stated about the indispensability of stress as extra physiological effort for a strong accent, it is to be inferred that the primary degrees of accent will always be associated with stress. It is these primary degrees which we are to call for reasons of exposition "accented", and the non-primary ones are to be called "unaccented". "Accented"

and "unaccented" should be taken to denote, unlike what the labels themselves suggest, steps in the same hierarchy.

Here are our suggested degrees of accent:

1. Primary tonic accent. This degree of accent will be marked where required with [\] before the syllable assigned it, as an indication of its tonicity (cf. Brown et al 1980:138-161), not as a type of tone. This is the most prominent degree of accent since it combines both an extra physiological effort and a marked pitch movement consisting in a fall, more often in a rise (Katwijk and Govaert 1967), or a glide. This tonic accent occurs in one-word utterances and in connected speech. Besides stress and pitch change, a tonic accent is characterized by a "full" vocalic nucleus. The word "full" here signifies as qualified by Berger (1955), that form of the vowel that is permissible in a monosyllabic one-word utterance where no reduced vowel can occur. This is of course the fullest quality a vowel can assume, and it represents a reference quality or in the words of Couper-Kuhlen (1986:23) "a norm for that particular vowel". The fourth characteristic of a tonic accent is appropriate duration of the accented syllable not necessarily in comparison with unaccented syllable(s) in the word but with what can be called "the reference duration" of that syllable where its vocalic nucleus is of full quality. It often happens, though, that a syllable with that degree of accent is longer than unaccented syllables in the same word. This degree of accent is characteristic of most of the syllables marked with a primary accent in a pronouncing dictionary like Jones' English Pronouncing Dictionary (EPD). Here are a few examples:

EXAMINATION/ /ɪg,zæmɪ[\]neɪʃn/

REPRESENTATIVE/	/ˌreprɪˈzɛntətɪv/
MEASURABLE/	/ˈmeɪʒərəbl/
MELODRAMATIC/	/ˈmeləʊdrəˈmætɪk/
UNIVERSITY AVENUE/	/ˌjuːnɪˈvɜːstɪˈævənjuː/
INCOMPREHENSIBILITY/	/ˈɪŋ kəmˌprɪhensɪˈbɪlɪtɪ/

See 2. below where the use of ^ˈ is explained. The use of the word "most" in the sentence before the last two is meant to allow for syllables receiving a primary accent marked with ^ˈ in the last three examples of the words listed above. Syllables thus marked receive the degree of accent described immediately below.

Note that the phonetic symbols we use throughout the thesis are International Phonetic Association (IPA) symbols with the same value attached to them in the EPD, 14th edition. See the Introduction to Chapter II with regard to the syllabification conventions adopted.

2. Primary non-tonic accent. This is the second most prominent degree of accent. The difference between tonic and non-tonic accent is that in the case of the latter degree pitch change is far too limited both in terms of range and excursion size across the time dimension. Syllables with this latter degree are also shorter in duration than they are when they receive tonic accent. There is evidence to suggest the independence of syllable-duration change from the variation in the scope of pitch change. Comparing what he calls "dominant" and "non-dominant" words (i.e. words that receive tonic and non-tonic accents according to our terminology), Nooteboom (1972:60-61) finds that the temporal patterns of both types of word "are very much alike and largely independent of the pitch accent". Similarly, Berkovits (1984), in a comparative study of the behaviour

of sentence-final accented syllables in English and Hebrew, argues:

"...that final stressed syllables in Hebrew and English show almost identical patterns of Fo movement while exhibiting no parallel similarities in duration, supports the independence of timing and Fo in sentence production" (1984:255).

This degree of accent is more common in long utterances (as distinct from one-word utterances) where there can be many accents in non-nuclear positions. In one-word utterances, however, double and multiple-accents are not infrequent and the former are even claimed by Kingdon (1958:15) to "form an unexpectedly large proportion of the English vocabulary...". Kingdon's claim is due to the fact that the EPD secondary accent is regarded by him as a primary accent. Double accentuation for words is controversial: while a word like UNKNOWN is shown with an "atonic" accent (i.e. a primary non-tonic accent) by Kingdon (1958:14) on the first syllable, Gimson, in his 14th edition of Jones' EPD, reserves a second primary stress in the word to "long polysyllabic words or compounds" with two secondary accents, where it is assigned to the earlier of the two in the word to show its comparative prominence in relation to the other one. Gimson warns against taking it as equal in prominence to the main primary accent (i.e. primary tonic one (1977:xxiii)).

That syllables with the primary non-tonic accent are sometimes suspected (e.g. the warning by Gimson just referred to) to be equal in terms of physiological effort to syllables with the tonic accent is due to, as Arnold (1956/1957) rightly puts it, "...the prejudicial effect that the nuclear tone... can have on our judgement of stress" (1956/57:225). That is, the syllable with the tonic accent captures most perceptual prominence and relegates other syllables to

minor degrees. Sometimes, what Gimson marks as a secondary accent is treated by us as a primary non-tonic accent. As far as long utterances are concerned, this stance is also not in line with that of Cruttenden (1986:52) who regards all accented syllables in the sentence that do not receive tonic accents to be receiving secondary accent.

Examples of this degree of accent in disyllabic words are, as one would expect, rare:

UNKNOWN/	/ 'ʌn\ nəʊn/
PAYEE/	/ 'peɪ\ i:/
NON-STOP/	/ 'nɒn\ stɒp/
RED-HOT/	/ 'red\ hɒt/

It is clear that these are compound words made up either of two otherwise individually free elements or of agentive affixes plus roots unwilling to give up their primary accents. The same can be said of the following polysyllabic words;

ANTI-PERSONNEL/	/ 'æntɪps: sə\ nel/
CO-EXIST/	/ 'kəʊɪg\ zɪst/
MULTIMILLIONAIRE/	/ 'mʌltɪmɪljə\ neə/
SELF-SATISFACTION/	/ 'self, sətɪs\ fækʃn/

3. Non-primary unreduced (or secondary) accent. By

"non-primary", we mean an accent that is minus extra physiological effort (associated with primary tonic and non-tonic accents), yet is still of considerable prominence on account of retaining its full vowel quality and its relatively greater duration than if it were of reduced quality. We tentatively believe that secondary accent is not an intermediate degree in terms of general physiological effort (see the Sub-section on the physiology of stress, page 37 ff) across the speech channel between unaccented syllables (see the fourth

degree of accent immediately below) and those with primary accent. The amount of effort required for producing a monosyllabic one-word utterance (e.g. /tɪt/ or /tæt/) should not, we believe, be regarded as plus or minus effort, but rather the intrinsic effort for producing it, that is, the norm from which there can be minus or plus deviations. This belief is in line with the "source filter theory" of speech production according to which "The differences in vowel quality are independent of the activity of the larynx. They are the consequences of changes in the shape of the supralaryngeal airway" (Lieberman 1977:33). This is to say, the production of full vowel quality is achieved by a posture that the upper part of the speech channel assumes and not by an effort exerted throughout that channel.

A large proportion of the syllables receiving this degree of accent are those with primary accents in related words. Here are some examples marked with , :

EXAMINE/ /ɪgˈzæmɪn/ vs EXAMINATION/ /ɪg,zæmɪˈneɪʃn/
 MECHANIZE /ˈmekənaɪz/ vs MECHANIZATION/ /,mekənaɪˈzeɪʃn/
 PROVINCIAL /ˈprəˌvɪnʃl/ vs PROVINCIALITY/ /prəˌvɪnʃɪˈæləti/
 RITUAL/ /ˈrɪtʃuəl/ vs RITUALISTIC/ /,rɪtʃuəlɪstɪk/

Not all syllables with this degree of accent receive primary accents in related words. Here are some examples of this:

REVOLUTION/ /,revəˈluːʃn/
 CATASTROPHIC/ /,kætəˈstrɒfɪk/
 ADVANTAGEOUS/ /,ædvənˈteɪdʒəs/

The principle at work here is a distributional one: the tendency not to have two syllables or more at the beginning of a word with reduced vocalic nuclei (cf. Berger 1955).

4. Non-primary reduced accent. This is perceptually the least prominent degree of accent associated with syllabic consonants, syllables with schwa or any other vocalic nucleus of reduced quality. Syllables with this degree are the ones we refer to as unaccented throughout the thesis. Slight differences in terms of prominence are bound to exist among syllables with this degree of accent on account of differences in the distinctive attributes of the syllabics (i.e. intrinsic length and inherent sonority), but no practical classification of accentual degrees can be made on the basis of these differences. Here are some examples where syllables with this degree are left unmarked:

AUCTIONARY/ /^ˈɔ:kʃənərɪ/

COMBUSTIBLE/ /kəmˈbʌstəbl/

MUDDLE/ /^ˈmʌdl/

RESCUING/ /^ˈreskjʊɪŋ/

It is to be noted that only syllables with syllabic consonants, schwa or reduced /ʊ/ or /ɪ/ are cited as examples of this degree. This is in contrast with the EPD which classifies syllables with other vowels as unaccented syllables. Along with Arnold (1956/1957), we regard such syllables to be as prominent as those described in 3 above (i.e. syllables with secondary accent). See the results of Tests D, G and L supporting our classification. Here are some examples of this category of syllable marked with ₁:

EXERCISE/ /^ˈeksə₁səɪz/

HUNTING-CROP/ /^ˈhʌntɪŋ₁kɹɒp/

MOUNTJOY/ /^ˈmʌvnt₁dʒɔɪ/

The relationship between the factors of accent and the accentual degrees so far postulated in this Section is summarized

schematically in Figure 1 where:

$$1 = A + B + C.$$

$$2 = B + C.$$

$$3 = C.$$

$$4 = 1 - (A + B + C), \text{ or}$$

$$4 = 2 - (B + C), \text{ or}$$

$$4 = 3 - C.$$

A number of related concepts have to be viewed within the perspective of the approach suggested so far in this Section. First of all, there is the assumption that the so-called word-accent and sentence-accent are two dissociable domains (cf. Bolinger 1958a; Jassem and Gibbon 1980; Lightfoot 1970). This dissociation implies that there is such a thing as is usually called "the word in citation form" (cf. Thompson 1980:113; Bolinger 1986:58). The latter concept seems to be based on the fact that the acoustic form of the word is likely to undergo some modifications from one-word to longer utterances (e.g. to concede its tonic accent for a non-tonic accent, or to assume a different pitch contour). To take this concept for granted would leave us committed to some of its questionable implications:

(i) that it is not possible for the word to occur in longer utterances with exactly the same phonetic form it has as a one-word utterance. This is not the case. Even as a one-word utterance, the word cannot be presumed to have a completely stable acoustic form, or accentual pattern. A word like UNBELIEVABLE may on being picked up from a dictionary be pronounced with the tonic accent on the first syllable just as it usually does on the third.

(ii) that the amount of modification the word undergoes in

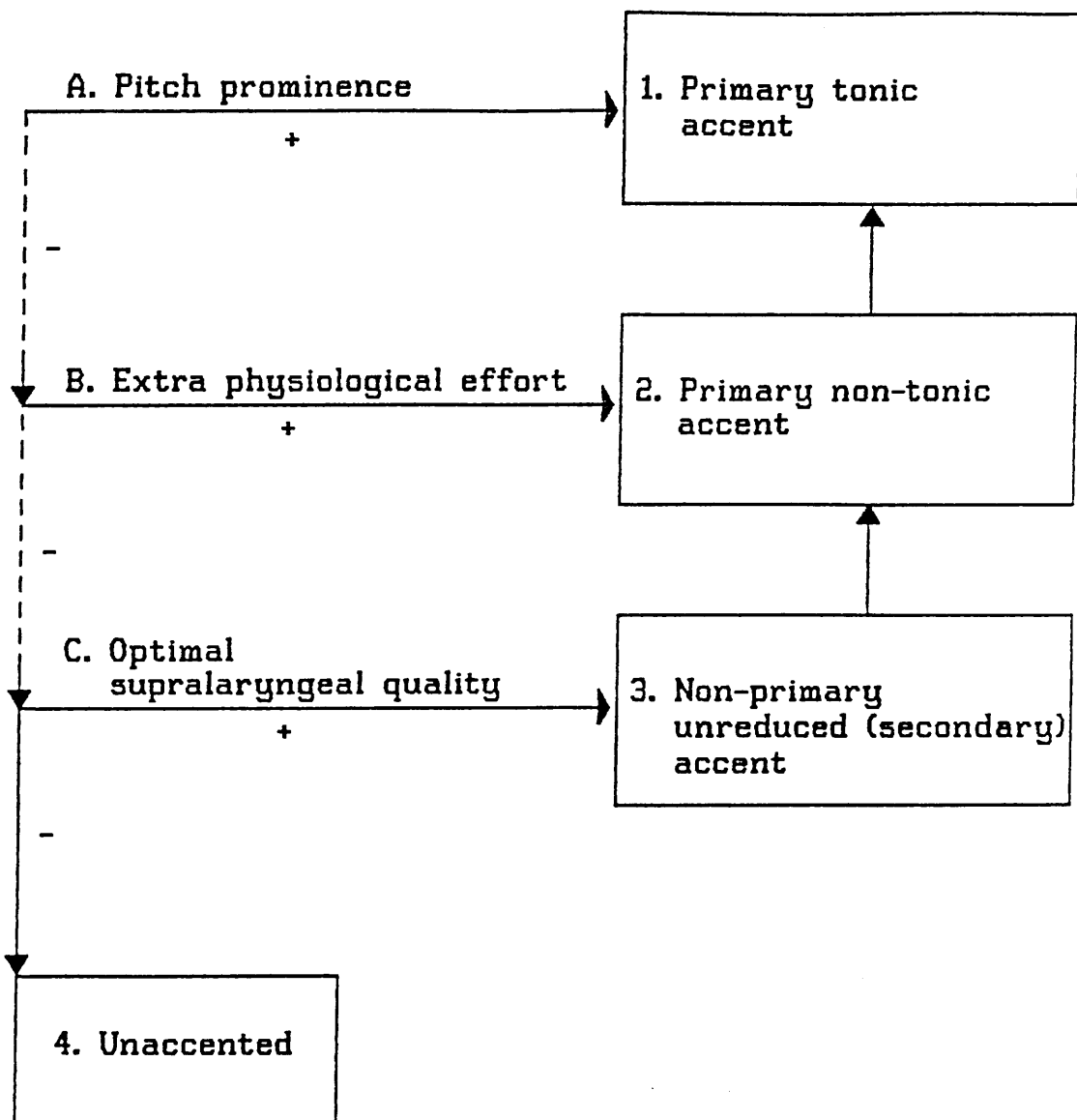


Figure 1: A schematic diagram of the relationship between the factors of accent and the accentual hierarchy.

longer utterances outweighs the form it retains. If this were the case the entity of the word in longer utterances would be completely lost. Huss's results (1978) on the perception of the accentual patterns of noun/verb minimal pairs embedded in sentence frames seem to suggest this as he writes:

"...rhythm is an important factor for the perception of stress in the post-nuclear position and that listener responses are independent of the lexical stress pattern. They tend to hear those syllables as stressed which fit into a regular stress sequence no matter from what type of carrier sentence they are taken or which is the lexical pattern involved" (1978:104).

Along with other investigators (cf. Barry 1981; Cutler 1984; Williams 1986), we reject the argument that accent perception is independent of the lexical accentual pattern of words on the ground that this independence would render the process of speech production and perception extremely difficult and probably impossible. To quote Barry:

"The fact that the tonal contour they possess when produced in citation form is often lost in context does not mean that polysyllabic words lose their accentual structure in unaccented positions. Even in cases of neutralized intensity and level tone, the word retains its accentual identity... on the strength of its temporal structure..." (1981:329).

Our experimental results (Test K) strongly indicate that the word retains its temporal structure in longer utterances and make the dissociation of so-called word-accent and sentence-accent unnecessary. Our argument in this respect should not be taken to discount any context in which the terms are used as Guierre (1967) refers to a sense in which the distinction can be useful. He

considers the patterns of sequences of different degrees of accent in sentences and specifies certain patterns which are not possible in individual words.

The second notion that should be viewed in the light of our suggested approach concerns the freedom of accent in connected speech. The misconception that accent in connected speech is free compared with word-accent that is bound to a certain syllable in a given word (cf. Gimson 1980:256; Hewson 1980) is due to the lack of distinction between tonic and primary non-tonic accent. Only the tonic accent is free to be within one word or another in a long utterance, but not as free to move from one syllable to another in the same word; it is nearly bound to the same syllable within the word. The word "nearly" is used in this context to allow for the comparative freedom of the tonic in multi-accented words (see Test B) and occasional non-lexical accentuation (see Test J). We referred above (page 12) to an instance cited by Beckman (1986) that shows how lexical accentuation is not always free to be shifted to any syllable.

The definition of accent adopted here is not in conformity with the purely intonational view of accent set forth by O'Connor and Arnold (1973). Speaking of the pattern of prominence throughout a long utterance makes them regard some non-nuclear accented syllables as unaccented. Though such syllables may be less prominent in relation to others in the utterance, they certainly retain their prominence as far as their respective words and their tone-group elements are concerned. O'Connor and Arnold state that "When stresses occur... in preheads and tails, they do not indicate accents" (1973:33). Thus, in these examples of theirs:

ANDREW CERTAINLY TRIED (1973:31).

SEND IT TO HIS HOME ADDRESS (1973:31).

the first syllable of ANDREW and the second of ADDRESS are marked as unaccented for occurring in a prehead and a tail respectively. If this was the case, the two syllables of each of these two words would show no difference in terms of prominence and the words would lose their identity in the long utterance.

The overlap in the use of the terms "accent" and "stress" results in speaking of degrees of stress as effort instead of degrees of accent (Gimson 1980:222; Guierre 1970: 7 ; Jones 1960:247; Katwijk 1972; Newman 1946). As already pointed out, we restrict the term "stress" to the extra physiological effort that exists in the case of the syllables with primary accents (i.e. tonic and non-tonic) and does not exist in the case of syllables with non-primary accents (i.e. secondary and unaccented). The amount of effort still existing in the non-primary accents ranges from the minimum syllable-producing effort characteristic of the syllables typically called "unstressed" by Jones to the optimal but not excessive syllable-producing effort characteristic of the syllables assigned secondary accent by the EPD, together with others we regard as inconsistently marked by the EPD like the second syllable of ¹CONVERSELY for instance.

4.

Functions of Accent

The aim of this Section is to show how the existence of the dichotomy of accented and unaccented syllables is indispensable for speech production, perception and understanding. In doing so, the

section will take into account the functions of accent.

Theoretically speaking, the production of speech would seem extremely difficult if not impossible if all syllables were to be assigned equal degrees of physiological effort. Unaccented syllables have to be dependent on the production of the intervening accented syllables. In the words of Fowler (1977:158-159):

"...the role of stress may be to subsume the production of some vowels (those that are destressed) under the production of the remaining stressed vowels. A general advantage of adding a level of constraint to a system is one of simplification (Simon, 1969, 1973; Pattee, 1972)".

From the point of view of perception, phoneme-monitoring reaction time experiments (e.g. Cutler and Foss 1977) have shown that accent plays an important role in sentence comprehension. Reduced reaction-times characterize accented syllables (compared to unaccented syllables) in those experiments, and this has been attributed to both the "perceptual clarity" of accented syllables and "the prediction of upcoming accents"(see the Section on the way accent is perceived, page 219 ff)

An issue that has to be touched upon at this point is that of how accent is perceived despite the fact that there is no one-to-one correlation between the perception of accent and any single acoustic parameter (Adams and Munro 1978; Bolinger 1958a:21-36; Fudge 1984:2; Ladefoged 1967a:46; Lehiste 1970:113-120). Perceptual prominence is reported by Lehiste to be almost unanimously directly proportional to the physiological effort rather than to the physical intensity of two sets of vowels having the one factor constant, the other variable and vice versa. The explanation she offers for this

phenomenon is that:

"...the listener may associate a certain intrinsic relative amplitude (or perhaps average power) with each vowel spectrum, and apply a corresponding "correction factor" to the incoming signal... this procedure would enable a listener to identify a stressed syllable, even if the average or/peak power of that syllable were less than that of an adjacent unstressed syllable..." (1970:118-119).

This idea of a "correction factor" is in line with Gimson's (1956) earlier conception of accent as "a reciprocal action of linguistic recollection" (see the Sub-section on the models and theories of accent perception, page 231ff).

The advantage the accented syllables have in terms of accentual prominence is a prerequisite for linguistic communication. The prominent syllables act as attention markers of the semantically most important items in the sentence (cf. Bolinger 1958c; Brown et al 1980; Currie 1981). The importance of an item is decided by its newness. The newness of an item, in turn, as rightly noted by Brown et al (1980:160), does not depend on whether the item has been mentioned before or not but on what is implied in the way it is introduced (i.e. recoverable or not). In the context of:

A - CAN YOU SPELL IT?

B - SPELL IT?

SPELL in B is introduced as new because it has a different attitudinal function (expressing "puzzlement") from its function in A (expressing "demand").

Conveying contrast is also often referred to as one of the functions of accent (cf. Bing 1979:210-215; Bolinger 1961; and Lehiste 1970:151). For our purposes, a contrastive accent can be

defined as a primary tonic accent that involves a greater physiological effort and consequently a greater perceptual prominence than does a normal tonic accent. Hence, it is sometimes called "emphatic" accent (O'Connor and Arnold 1973:36-38; Atkinson 1973:238-241), or "accent of intensity" (Heffner 1950:299).

Atkinson (1973:239) notes:

"Generally, but not always, if "emphasis" is involved there is a tendency for heightened Fo on the prominent syllable, while Fo for the rest of the contour is lower than in a similar sentence without emphasis."

The traditional concept of contrastive accent can be attributed to an endeavour to account for an intonational feature, namely that of "double nuclei" (O'Connor and Arnold 1973:28-30; Lindstrom 1978:92), where two words in a tone group receive tonic accent, as in:

HE \wedge PROVED LONG AGO THAT THIS CONCEPT WAS \backslash FAULTY.

where both PROVED, with its rise fall, and FAULTY with its fall receive tonic accents. In his article "Contrastive accent and contrastive stress", Bolinger (1961) remarks:

"The pattern in question is simply one in which there are two semantic peaks, the first of which makes a strong comment on the second, and in point of statistics we have more use for this in assigning contrasts than in anything else..."
(1961/1965a:104).

Only the second part of this quotation is not approved of for there would be no point in singling out this pattern as contrastive while it is submerged in a larger class (namely "new" versus "given" from the point of view of the information structure (cf. Brown et al

1980)). Bolinger's contention seems to be due to the pedagogical misconception that there can only be one tonic accent per tone group. Experimental evidence (cf. Bing 1979:238-239; Brown et al 1980:160; Currie 1981) shows conclusively that there can be several tonics in the tone group.

We agree, however, with Bolinger (1961) and Atkinson (1973:241) that most of what has been described as contrastive or emphatic accent may not be linguistically relevant. In Atkinson's words, "It seems more to behave on a paralinguistic level as indicating the speaker's emotional state or degree of conviction". Bolinger undermines the distinction of contrastive accent because it is not, as he argues, "phonetically definable". He writes "It is the same as other highlighting by means of pitch accent, though it leans to the extreme of the scale..."(1961/1965a:116).The contrastive function of accent is indisputable only when a shift of accent (i.e. a deviation from the lexical accentual pattern of the word) is involved, as in:

I SAID HARMFUL, NOT HARMLESS.

where the syllables #FUL# and #LESS# rather than the two tokens of the #HARM# syllable receive accents, the latter being phonemically identical. In such cases, contrastive accent is no doubt phonetically definable.

In referring to those types described as contrastive in the literature, we are not concerned with the semantic distinctions between them. We rather suggest that, from the phonetic point of view, contrast, emphasis or any other semantic category demanding this extreme accent should be subsumed under the label "extra-strong accent". See Test J for the durational implementation of this type

of accent.

As far as words are concerned, the variation of the degrees of accent assigned to the sequence of syllables constituting disyllabic and polysyllabic words gives each word its characteristic pattern of prominence. This pattern is indispensable in speech production and perception (cf. Barry 1981; Cutler 1984; Williams 1986). To quote Cutler:

"Word stress patterns are part of the lexical identity of words, not arbitrarily assigned by rule; thus in language production lexical stress patterns are part of the information about each word which is stored in the mental lexicon and retrieved when the word is looked up as a sentence is spoken. Similarly, identification of stress pattern is part of word identification and is used in the process of looking up a word in the mental lexicon during the understanding of a sentence" (1984: 89).

Besides this general lexical function, accent acts as a distinctive feature in the case of minimal pairs like:

INSULT (n.) , INSULT (v.)

CONVERT (n.) , CONVERT (v.)

SUBJECT (n.) , SUBJECT (v.)

where the grammatical categories of verb (v.) versus noun (n.) are realized by the primary accent and non-primary reduced accent exchanging positions. It should be added, however, that the syntactic possibilities of the sound sequence constituting the word do play a role in deciding whether it is a verb or a noun. Accent also characterizes morphemes in multimorphemic words like:

¹MELODRA`MATIC

¹DISRE`GARD

¹DIA`TONIC

The prominence of a monosyllabic morpheme or of one syllable in a larger morpheme underlines the shade it adds to the ultimate meaning of the word. This last function is best expressed in these general linguistic terms by Martinet (1952):

"Accent is really there to characterize and localize the word (or a certain type of morpheme or phrase) in the spoken context. If the localization is approximate, its function has been called culminative. If it is accurate its function is demarcative" (1952:29).

We turn now to the rhythmic function of accent. Whatever the approach to speech rhythm of particular authors may be, accent is generally thought to be responsible for certain features of rhythm (Abercrombie 1964a, 1964b, 1967:96-98; Bolinger 1965b; Gimson 1980:258-260; Heffner 1950:227-228; Jassem 1949, 1952a:38-42, 1952b; Jones 1960:237-243; Lehiste 1975, 1977, 1980; O'Connor 1968; Nakatani et al 1981). The principle underlying the relation between accent and rhythm is that accents (i.e. primary accents) occur at relatively equal intervals of time. Measurements of the inter-accent intervals (Benguerel and D'Arcy 1986; Bolinger 1965b; Dauer 1983; Knowles 1974; Lehiste 1975; Nakatani et al 1981; O'Connor 1965) do not support such a theory of isochrony. O'Connor (1968), for instance, experimented by means of a frame-variable technique with the variation in the number of segments of a monosyllable. Deviation from the directly proportional relation between the duration of the variable and its segmental size showed up only in the case of the lowest and highest numbers of segments. This could be attributed to a tendency to have minimum and maximum limits for the duration of consonant clusters.

The theory of isochrony, therefore, might have come into being through an assumed similarity between the rhythm of verse and that of non-stylized forms of speech. At this point, the term "speech rhythm" itself may seem questionable on the basis of an analogy with rhythm in general (i.e. the patterning of events in time). Another approach to speech rhythm can be countenanced, though, if we set aside the timing of inter-accent intervals and consider the nature of the syllables constituting these intervals on the planes of production and perception.

Given that accented syllables are associated with peaks of subglottal pressure (cf. Ladefoged 1967a:44-77) and with peaks of general muscular tension (cf. Kent and Netsell 1971), that they are longer than when they are unaccented (cf. Nakatani et al 1981), that their nuclei are of such full quality that they can occur in monosyllables in isolation (Berger 1955), and that they are associated with pitch change or special pitch movements (O'Connor and Arnold 1973:31-36), we are strongly of the opinion that speech rhythm consists in the psychological effect of the alternation of strong and weak events. The physiological and acoustic overriding effect of the accented syllables excludes the unaccented syllables to an out-of-focus-like position. While the perceptual length of an even event (e.g. a dash in Morse code) is correlatable with its physical length (Lehiste 1970:17), the succession of strong and weak events is bound to affect such a correlation. Lehiste (1970:16) reports Wallach et al (1949) to have found that a subsequent more intense sound overrides the "precedence effect" of one that is earlier in time but of less intensity. In the case of speech, the variation in the duration of inter-accent syllables is overridden by

the occurrence of accented syllables; which creates an illusion of the equality of the intervals among these latter syllables. This is to say that speech rhythm, unlike rhythm in general, is not the arrangement of movements in time, but rather the effect of the patterning of movements upon the perception of time.

The division of utterances into so-called rhythm units seems to be one of the traces of an assumed analogy between verse rhythm and ordinary speech rhythm. There is a marked difference among the authorities as to the basis for this division. Abercrombie (1964a, 1964b, 1967:96-98) and Catford (1977:85-92) use the foot as prosodically conceived (i.e. an accented syllable or a group of syllables beginning with an accented syllable and extending to but not including the next accented syllable) as the rhythm unit

e.g./THIS IS THE/ BOOK I'D/LIKE TO/READ/

where the obliques mark the boundaries of the rhythm units.

O'Connor (1973:238:-239), on the other hand, allows for the syntactic and morphological relations between accented and unaccented syllables to decide which accented syllable might best associate with an unaccented syllable to form a rhythm unit

e.g./¹CHEAP/A¹FFAIRS/

/¹CHEAPER/¹FARES/

/¹TAKE THEM/FOR A¹WALK/

This difference in the bases for the division of utterances into rhythm units is significant for it shows the arbitrariness of such division.

It is clear that according to the view of speech rhythm postulated above, accent plays a fundamental role in marking the character of English speech rhythm. English rhythm is often

described as "stress-timed" (cf. Abercrombie 1964a 1964b, 1967:97-98; Catford 1977:87-88; Dauer 1983; Pike 1945:34) as compared with another category of language (e.g. French, Spanish) described as "syllable-timed". Dauer (1983), analysing this classification of languages, remarks that:

(i) More than half of the syllables of French and Spanish have a CV structure whereas in English there is a great variety of syllable structures.

(ii) Vowel reductions in English are "stress-conditioned" while in French and Spanish reductions result in complete elimination of syllables.

(iii) The range of inter-accent intervals is more restricted in English (with a maximum of five syllables in conversational English) while in Spanish they contain up to nine syllables. These remarks are very significant for a long series of syllables of more or less similar syntagmatic structure will not fail to be each nearly as much in-focus as an accented syllable in English can be. Once the all-or none prominence pattern of syllables is disturbed, syllables, rather than accents, will turn to be the pivot of rhythm.

We should indicate before concluding this Sub-section on the rhythmic function of accent that there have been other attempts to improve on or justify the theory of isochrony (Darwin and Donovan 1980; Fowler 1977; Lehiste 1977; Tuller and Fowler 1980). Darwin and Donovan (1980), studying the perception of the intervals between the vowel onsets of accented syllables, conclude that perceptual isochrony exists only within each tone-group and not over a series of tone-groups. Fowler (1977) interprets "stress-timing" in a wider context other than the timing of speech movements. For her, it

includes not only the timing of movements but their force and extent as well. To quote her:

"Trajectories of the tongue body are planned from stressed vowel to stressed vowel across any intervening unstressed vowels... In consequence unstressed vowels are "crushed" together; that is, they are low in amplitude, F_0 , muscular force and in the extent to which they deflect the tongue body from its stressed vowel to stressed vowel trajectory" (1977:168).

Lehiste (1977) argues that the physical durational variation in the inter-accent intervals is predicted by the listener and regarded as part of the grammar of the language as perceptual isochrony itself is. Tuller and Fowler (1980) report a form of physiological isochrony corresponding to both isochronous and non-isochronous acoustic signals where informants were instructed to produce isochronous sequences.

We sum up the functions of accent detailed above as follows:

1. Accent facilitates speech production by subsuming the production of unaccented syllables under the production of accented ones (cf. Fowler 1977).

2. Accented syllables act as attention markers for the semantically most important words in the sentence (cf. Bolinger 1958c; Brown et al 1980, Currie 1981).

- 3, Semantic categories like contrast and emphasis are conveyed by an extreme form of accent which we call "extra-strong accent".

4. The variation of the degrees of accent assigned to the sequence of syllables constituting disyllabic and polysyllabic words gives each word its characteristic pattern of prominence, which helps in its retrieval in sentence production and its identification

during speech perception and understanding (cf. Barry 1981; Cutler 1984; Williams 1986).

5. Accent acts as a distinctive feature in the case of minimal pairs like INSULT as both verb and noun (Vanvik 1961:42-63).

6. Accent characterizes morphemes in multimorphemic words.

7. The pattern of alternation of accented and unaccented syllables is responsible for the feature of rhythm in so-called stress-timed languages like English (cf. Dauer 1983).

5. Factors of Accent

Accentual prominence depends for its gradation on combinations of the factors of stress, pitch, quality and quantity. We devote a Sub-section to each of these factors below. In each Sub-section, we show how the factor in question participates in producing and signalling accent.

A. Stress

Introduction:

We have stated above (see page 6) that the term "stress" is to be restricted in this study to what the speaker does in terms of physiological effort to make certain syllables more prominent perceptually than others for the listener. In fact, the relation between accent and stress, as we take it, is such that if there is extra physiological effort (i.e. stress) there is a primary degree of accent and vice versa (see page 14 ff). If, however, a syllable is produced, with the optimal but not excessive physiological

effort, it is then said to receive a secondary accent (i.e. non-primary unreduced accent). If it is produced with effort that is weaker than the optimal value, it is said to be unaccented (i.e. non-primary reduced accent).

Stress as Rhythm:

It is relevant before dealing with the physiology of stress to touch upon an alternative approach to the nature of stress, namely stress as rhythm. The forerunner of this approach is Jassem (1949, 1952a:38-42, 1952b). He does not countenance any definitions of stress as having to do with gradations of force. To him, stress is rather rhythmical in nature. That is, it has to do with the "somewhat constant period of time peculiar to a given style of speech" taken by a syllable or a sequence of syllables (1952b:30). As indicated above (see page 31), measurements of the inter-accent intervals (cf. Bolinger 1965b; Dauer 1983; Knowles 1974; Nakatani et al 1981; O'Connor 1965, 1968) do not support the notion of isochrony upon which Jassem's approach is founded. Jassem suggests that a stressed syllable is that which occurs at the beginning of a rhythm unit. This is not enough to distinguish a stressed syllable from an unstressed one because it presupposes that rhythm units are phonetically definable without taking the concept of force into account. Recent postulations of stress as rhythm can be found in Couper-Kuhlen (1986: 33-35), Fowler (1977:168), and Ladd (1978 - cited in Couper-Kuhlen 1986:33).

The Physiology of Stress

We turn now to the physiology of stress. Unlike stress in

physics and engineering which can be looked upon as the reaction of "a body... under the action of external forces" (Wang 1952:1), stress in speech is the outcome of the interaction of the peripheral systems, namely the pulmonary, phonatory and articulatory mechanisms. Netsell (1969) adopts such a view in taking stress to be the responsibility of different rather than one physiological system:

"In many cases, previous researchers have concluded that only one of the systems is responsible for stress phenomena. The present results suggest strongly that all three systems are involved in effecting changes in stress" (1969:112).

We review below the literature on the participation of each of the peripheral systems in the production of stress.

I. The pulmonary system:

Three aspects of the pulmonary mechanism can be considered in relation to stress: (1) the activity of the respiratory muscles, (2) the variations in subglottal pressure and (3) what Netsell calls "the speech production power".

In an overview of his own work and that of his co-workers, Ladefoged (1967a) investigates the activities of different respiratory muscles (e.g. the diaphragm, external intercostals, internal intercostals, external obliques, rectus abdominis and latissimus dorsi) that may be correlated with stress. Good correlation has been found to exist between the activity of internal intercostal muscles and "phonetic stress" as peaks of this activity coincide with or immediately precede the syllables judged to be stressed (1967a:21-22). The activity of the rectus abdominis muscle

showed up only in the case of "very emphatic stressing" (see page 29 above).

Subglottal air pressure is regarded by some investigators (cf. Harris et al 1969; Ladefoged 1967a; Lieberman et al 1970) as the prime physiological correlate of stress. Fo variations between a sentence like THAT'S A PERVERT and one like HE DIDN'T PERVERT - which correlate well with subglottal pressure variations - are ascribed by Ladefoged to "the pressure driving the vocal cords" (1967a:47).

As reported by Ohala (1977), Lieberman's 1967 thesis Intonation, Perception and Language sparked a controversy as regards pitch variations that accompany stresses: are they controlled by the laryngeal muscles or by the pulmonary system? This has simply been called the "larynx versus lungs" controversy by Ohala (1978). Lieberman adopted the latter view since momentary Fo rises on stressed syllables in his data coincided closely with momentary increases in subglottal air pressure. The amount of Fo increase Lieberman and his co-workers (e.g. Lieberman et al 1969) report as a result of the chest compression manoeuvre (20 Hz) is not matched or even approached in later experiments of the same procedure (Netsell 1969:51-54; Ohala 1977; Ohala 1978; Ohala and Ladefoged 1969). This is not to say that subglottal pressure has no effect whatsoever on Fo variation, but that it cannot be regarded as the single factor controlling Fo. In a study of the physiological factors controlling Fo, Atkinson (1978) concludes:

"It is obvious from the results presented that there are many ways of controlling Fo and that many muscles (both laryngeal and respiratory) may be involved at any given instant. This is strong evidence against any one-to-one mapping between phonetic features,

articulatory implementation , and acoustic signal" (1978:220).

The major role of subglottal pressure and indeed the whole pulmonary system in the case of emphatic stress (see page 29) seems to be beyond dispute (Harris 1970; Netsell 1969:129; Ohala 1977).

To quote Netsell:

"It may well be that the sublaryngeal system is subordinate to the laryngeal system in effecting minimal stress contrasts. It appears that in generating stronger stress contrasts the sublaryngeal system assumes a strong, if not a predominant, role in the stress process" (1969:122).

Subglottal pressure is the dominant factor in controlling F_0 in its low range and in statements rather than questions (cf. Atkinson 1978; Gelfer et al 1987). Subglottal pressure has been even found to be indispensable in effecting the minute vowel intrinsic F_0 variations (Steele 1985:142, 1986).

The third sublaryngeal factor is that called "speech production power" by Netsell (1969:48-51). This factor is the product of subglottal pressure and volume velocity of airflow. Measuring speech production power in midvowel points, Netsell finds that this factor is not so effective as subglottal pressure in predicting ratings of stress.

II. The Phonatory System:

The consensus of opinion tends to support the view that F_0 variations are mainly effected by laryngeal adjustment (Collier 1974, 1975; Katwijk 1971; Netsell 1969:118-119; Ohala 1977; Ohala 1978; Ohala and Hirano 1967; Ohala and Ladefoged 1969). Ohala (1977)

reports that Vanderslice (1967), through recording the vertical movements of the larynx and subglottal pressure, found that the former was in better synchronization with Fo variations. Collier (1974, 1975), Netsell (1969:56-60) Swashima et al (1969), Swashima and Hirose (1983) study the activities of individual laryngeal muscles in relation to Fo variations. The activity of the cricothyroid muscle is found to be in direct correlation with the major Fo changes: Fo rises are effected by the contractions of that muscle and Fo falls are caused by its relaxation. The sternohyoid, the sternothyroid and the thyrohyoid muscles have no direct effect on Fo.

The intriguing relationship between subglottal pressure and Fo changes has to be touched upon once again at this point. We have indicated above (see page 40) that the growing bulk of evidence supports the view that Fo changes are independent of subglottal pressure changes apart from the gradually falling baseline of Fo. Nevertheless, Fo, subglottal pressure and vowel amplitude contours simultaneously recorded for the same utterance are found by Netsell (1969:101-105) to be quite similar in the level changes (i.e. higher or lower levels) from vowel to vowel. To quote Netsell:

"By noting the extent to which Fo and vowel amplitude contours followed psg (i.e. subglottal pressure - our parenthesis) contour in the speech data, it is tempting to speculate that the vocal folds developed a basic tension state for speech and their varying output of Fo and amplitude may be a simple linear function of psg" (1969:102).

A similar remark is made by Vanderslice (1967 - reported in Netsell 1969): "Intonational pitch control is primarily vested in the larynx" and subglottal pressure "is programmed to be sufficient to

enable the larynx to carry out its role" (1969:11-12). Katwijk (1971) suggests another way of looking at the relationship between stress and subglottal pressure; namely that the variations of the latter are effected by those of the former. He writes:

"... small fluctuations of subglottal pressure, such as may be found in normally stressed syllables, do not necessarily stem from respiratory actions of the relevant muscles. They may derive - as far as the order of magnitude is concerned - from increased glottal and supraglottal resistences" (1971:34).

III. The articulatory system:

The supralaryngeal participation in stress consists in the lengthening of segmental duration, the increase in the activity of the muscles involved and the increase in the magnitude of articulator displacement. Tuller et al (1981a, 1981b, 1982a) maintain that unlike speech-rate-based lengthening, stress-based lengthening is coupled with increased activity in the muscles involved (e.g. lips in the case of bilabial plosives, and tongue fronting in the case of /ɪ/ and /e/). They later (1982b) find that the timing of consonant related gestures is tightly linked to the timing of those related to the "flanking vowels" irrespective of variations in displacement and velocity of individual gestures. Harris et al (1968) came to the significant finding that increasing stress on a word will affect the upper articulatory behaviour concomitant with its utterance (e.g. the extent of displacement of articulators and the amount of activity of the muscles involved). Harris (1971, 1973, 1978) maintains that articulators receive longer signals for stressed syllables on account of which those syllables become longer and have "more extreme formant values" for vowels (1978:354).

Through lateral view cinefluorography, Kent and Netsell (1971) come to the conclusion that variations of stress, especially emphatic stress (see page 29 ff) influence the articulatory adjustment of the jaw, lips and tongue and the duration of vowels in such a manner that is compatible with "the view that increases in stress are associated with increases in the muscular activity of the peripheral speech apparatus" (1971:43). In a study of motor unit activity as a function of emphatic stress in various tokens of a disyllabic monomorphemic word, Sussman and MacNeilage (1978) conclude that there is "a more carefully orchestrated motor program for heavily stressed productions" (1978:338).

This brief review of the literature on the physiology of stress makes it clear that the physiological processes associated with stress are not exclusive to one peripheral system but are rather manifest on all three levels: sublaryngeal, laryngeal and supralaryngeal.

A Distributional Analysis of Stress in English Words:

We proceed now to give a brief account of stress distribution in some English words. By "distribution" in this context we mean the order from left to right of the syllable receiving the primary accent in its respective word. The term "stress" is used throughout this analysis since every primary accent, according to the approach adopted in this thesis, is associated with an extra physiological effort (i.e. a stress). Assuming that the variability in the stress patterns of some words could be a guide to the rules of stress placement in general, which, in turn, could help in setting forth some facts about the nature of accent, we consider below the

patterns of words with accentual variants in the EPD.

Any study of stress distribution would no doubt be seeking regularities in the stress patterns of words according to which general rules could be formulated. Those regularities are by no means absolute, leaving, as such, gaps in those potential rules. One would infer, for instance, from the following words:

ARTICULATORY /ɑ:ˈtɪkjʊlətəri/ or /ɑ:ˌtɪkjʊˈlətəri/

CIRCULATORY /ˌsɜ:kjʊˈlətəri/ or /ˈsɜ:kjʊlətəri/

CITATORY /ˈsɑɪtətəri/ or /saɪˈtɛtəri/

DEDICATORY /ˈdedɪkətəri/ or /ˌdedɪˈkeɪtəri/

that these words have stress variants because they alternate the stress to a syllable that is stressed in root-related words (e.g. ARTICULATION /ɑ:ˌtɪkjʊˈleɪʃn/) This proves inapplicable in the case of RESPIRATORY /rɪˈspaɪrətəri/ or /ˈrespɪreɪtəri/.

Two categories of words with stress variants can be distinguished:

- (1) words the first syllable of which alternates with the second syllable in receiving the stress. We shall call these "words with early stress variants".
- (2) words the first or the second syllable of which alternates with the final syllable in receiving the stress. These will be called "words with late stress variants".

It was initially hypothesized that the difference between the two categories might have sprung from differences in syntagmatic and paradigmatic structures of the syllables constituting representative words of each. This proved not to be the case (see the lists below for examples).

The following are randomly selected lists of three-syllable and

four-syllable words shown in the EPD with at least two stress variants. Using the Oxford English Dictionary (OED), we checked the source-languages¹ from which these words have been introduced into English. We also checked the year they are supposed to have first come into English. Phonetic transcriptions are also included to show the vowel changes, if any, accompanying the stress shift.

Three-syllable words with early stress variants

Source	Year	word	Common variant	Less common variant

Lat.	1541	ABDOMEN	/\æbdəmen/	/əb\dəʊmen/
Lat. Fr.	1738	ASPIRANT	/ə\spairənt/	/\æspirənt/
Lat.	1566	CLANDESTINE	/klæn\destɪn/	/\klændestɪn/
Lat.	1603	CONDOLENCE	/kən\dəʊləns/	/\kɒndələns/
Lat.	1623	DETRUNCATE	/di:\trʌŋkert/	/\- - -/

1. Latin (Lat.), French (Fr.), Italian (It.), Greek (Gr.).

Three- syllable words with a late stress variant

Source	Year	Word	Common variant	Less common variant

It-Fr.	1623	ACCOLADE	/ ₁ ækəv`leɪd/	/ ¹ - - -/
Fr.	1678	BRIGADIER	/brɪgə`dɪə/	/ ¹ - - -/
It-Fr.	1654	COMPLIMENT	/ ¹ kɒmplɪment/	/ - - ¹ -/
Fr.	1787	CORDUROY	/ ¹ kɔ: dərɔɪ/	/ - - ¹ -/
It-Fr.	1854	FIGURINE	/ ¹ fɪgʃʊri:n/	/ - - ¹ -/
Fr.	1598	ESCALADE	/ ¹ eskəleɪd/	/ - - ¹ -/
Fr.	1611	MACAROON	/ ₁ mækə`ru:n/	/ ¹ - - -/
Fr.	1721	MIGNONETTE	/ ₁ mɪnjə`net/	/ ¹ - - -/
Fr.	1819	NICOTINE	/ ¹ nɪkəti:n/	/ - - ¹ -/
Fr.	1775	SOUVENIR	/ ₁ su:və`nɪə/	/ ¹ - - -/

Four-syllable words with a late stress variant

Source	Year	Word	Common variant	Less common variant

Fr.	----	AUTOMOBILE	/ ¹ ɔ: təməʊbi:l/	/ ₁ - - - ¹ -/
It-Fr.	1748	CARICATURE	/ ¹ kærɪkətʃʊə/	/ ₁ - - - ¹ -/
Spanish	1830	CONQUESTADOR	/kɒn`kwɪstədɔ: /	/ - ₁ - - ¹ -/

Four-syllable words with early stress variants

Source	Year	Word	Common variant	Less common variant

Lat-Fr.	1789	ARISTOCRAT	/\æristəkræt/	/- - - -/
Lat.	1646	COMPENSATIVE	/kəm'pensətɪv/	/\kɒmpənsətɪv/
Lat.	----	COMMISSARY	/\kɒmɪsəri/	/kə'mɪsəri/
Lat-Fr.	1611	FRAGMENTARY	/\frægməntəri/	/fræg'məntəri/
Lat.	1684	GUSTATORY	/\gʌstətəri/	/gʌ'stɛrtəri/
Gr.	1567	HEGEMONY	/hɪ'gɛməni/	/\hɛgɪməni/
Lat.	1643	ILLUSTRATIVE	/\ɪləstrətɪv/	/ɪ'ləstrətɪv/
Gr-Fr.	1810	KILOMETRE	/,kɪləv'mi:tə/	/kɪ'lɒmɪtə/
Lat.	1550	MILLENARY	/mɪ'lenəri/	/\mɪlɪnəri/
Gr-Lat.	1921	NARCISSISM	/nɑ:'sɪsɪzəm/	/_ - - - -/

On the basis of these lists alone, it is clear that the most important distinction between these two categories of word is etymological. French, Italian and Spanish are the source-languages for words with a late stress variant. Latin and rarely Greek are the source-languages for those with early stress variants. Distributional accounts of the accentual patterns of words can therefore resort to etymological classifications along with a synchronic approach.

A look at the less common variants, assuming that they mostly represent influences which are on the point of dying out, will show that they are competing to shift the stress to earlier syllables and

thus accomplish the native tendency for word-initial stressing (Guierre 1978:769; Kingdon 1958:12-13; Poldauf 1984:19-21). The longer the words are, the more extraneous late stressing is felt and the more fruitful the process of shifting the stress to an earlier syllable is. In three-syllable words, six out of the ten still have as their less common variant the one with a late stress variant. In all four-syllable words, the variant with early stress is the common one. Moreover, four-syllable words that can receive the stress on the final syllable are remarkably rare. Four-syllable words in which the stress is shown by the EPD to be fixed on the last syllable, are actually double-stressed words according to our approach.

e.g. CONCESSIONAIRE	/kən ¹ seʃə ¹ neə/
EVACUEE	/ɪ ¹ væk.ju: ¹ /
RECITATIVE	/ ¹ resɪtə ¹ ti:v/

It is to be noted also that the shift of stress from early to late syllables and vice versa is less likely to result in vowel reductions than is the case with the shift of stress to an adjacent syllable. This is in accordance with the tendency to alternate syllables with "full" and "weak" vocalic nuclei (cf. Arnold 1956/1957; Berger 1955). See the Sub-section on quality below, page 55 ff.

This brief résumé of stress distribution indicates that the position of the stress in the word is not determined by the syntagmatic and paradigmatic structure of its syllables. Whether the word has a variant with late stress is not decided by when it came into English but by its source-language. The number of syllables constituting the word affects its capability to have late

stress. Poldauf (1984) refers to the effect of vocabulary sources on the accentual patterns of English words when he writes:

"English word-stress is and continues to be a product of the flexible co-operation and conciliatory rivalry of patterns established and in process of being established in a language, in particular a language whose lexicon is hybrid in that it is built from disparate word structures" (1984:7).

B. PITCH

The term pitch is used in this context to refer to the perceptual correlate of fundamental frequency variation. What concerns us with regard to this parameter is not pitch baseline rises and falls, but rather momentary rises and falls correlative to accentual variations that are superimposed on that baseline (Katwijk and Govaert 1967, Lea 1973).

In the past, it was assumed that higher pitch is accent (e.g. Muyskens 1931). Jones (1960:246), for instance, argues that pitch is sometimes ineffective in achieving accentual prominence since accented syllables can be of lower pitch than unaccented ones. Bolinger (1958a) improves on the concept of prominence when he rightly maintains that accentual prominence can be achieved by pitch falls just as it can by pitch rises. Some investigators, though, indicate that different varieties of languages (including English) tend to use either falling or rising more frequently to cue accent (Brown et al 1980:19-20; Thorsen 1982).

We have referred elsewhere (page 11 ff and 226 ff) to the increasing evidence against Bolinger's (1958a) theory of pitch accent where he claims that accent is "pitch obtrusion" and other

factors are there only dependently. Various acoustic and perceptual studies (cf. Beckman 1986:145-197; Gaitenby 1975; Gay 1978; Vaissière 1983) have confirmed that no one-to-one correlation of a single parameter with accent can be consistently found, and that the parameters are more systematically correlated in a stress-accent language like English than in a non-stress-accent language like Japanese (cf. Beckman 1986) or French (cf. Vaissière 1983).

The most significant role of F_0 variations in relation to accent is in marking what we have called primary tonic accent. This includes any syllable with a pitch glide or any pitch movement deviating from the baseline of pitch, excluding of course the slight modulations of this baseline due to intrinsic F_0 variations of segments. Very often the pitch glide characteristic of a tonic accent occurs at the end of the utterance or towards the end (see examples in Figure 2 where the syllables receiving the tonic accent are written on top of their respective glides). Sometimes, there are tonic accents earlier on only in the utterance (see Figure 3 for examples). Sometimes, tonic accents occur both earlier on and towards or at the end of the utterance at the same time (see Figure 4 for examples). It should be noted in these Figures how syllables with non-tonic primary accent (at least those marked with primary accents in the EPD in disyllabic and polysyllabic words) show little or no pitch variations at all compared with the ones marked in those Figures as receiving primary tonic accents.

The intonation contour displays included in this Chapter (page 52 ff) and in Chapter III (page 135ff and page 195) were obtained by means of the computer program Fundamental Frequency Contour Display (Laryngograph, London) using a BBC Master 128

microcomputer.

Research is wanting on the role of F_0 in relation to other degrees of accent, especially primary non-tonic and secondary accents. It is possible in the light of the multiparametric interpretation of the acoustic manifestations of accent that F_0 variation is directly proportional to the variation across the accentual hierarchy. This assumption is based on the fact that durational variation has been found in this study (Chapters II and III) to be in such a relationship with accent.

Support for the assumption just stated comes also from a different area of investigation, namely that of intrinsic F_0 variation (Lea 1973; Rosenvold 1981; Silverman 1984). Lea (1973) reports a simple relationship between the F_0 rising or falling at onsets of vowels on the one hand and accent and the voicedness of prevocalic consonants on the other. He concludes:

"...it is unlikely that a stressed vowel preceded by a voiced consonant will yield a falling contour, and unlikely that an unstressed vowel preceded by an unvoiced consonant will yield a rising contour" (1973:61-62)

Rosenvold finds that "the F_0 step required to identify a certain stress pattern is of a different physical magnitude for a low than for a high vowel" (1981:147). Silverman (1984) dismisses the relationship claimed by Lea (1973). He still finds that the extent of F_0 fall before a consonant predicts the degree of accent of the following syllable; the greater it is in terms of range the higher across the accentual hierarchy the syllable is. This result of Silverman's is a much needed step on the road to closing the gaps in our knowledge about the relationship between F_0 and accentual variations.

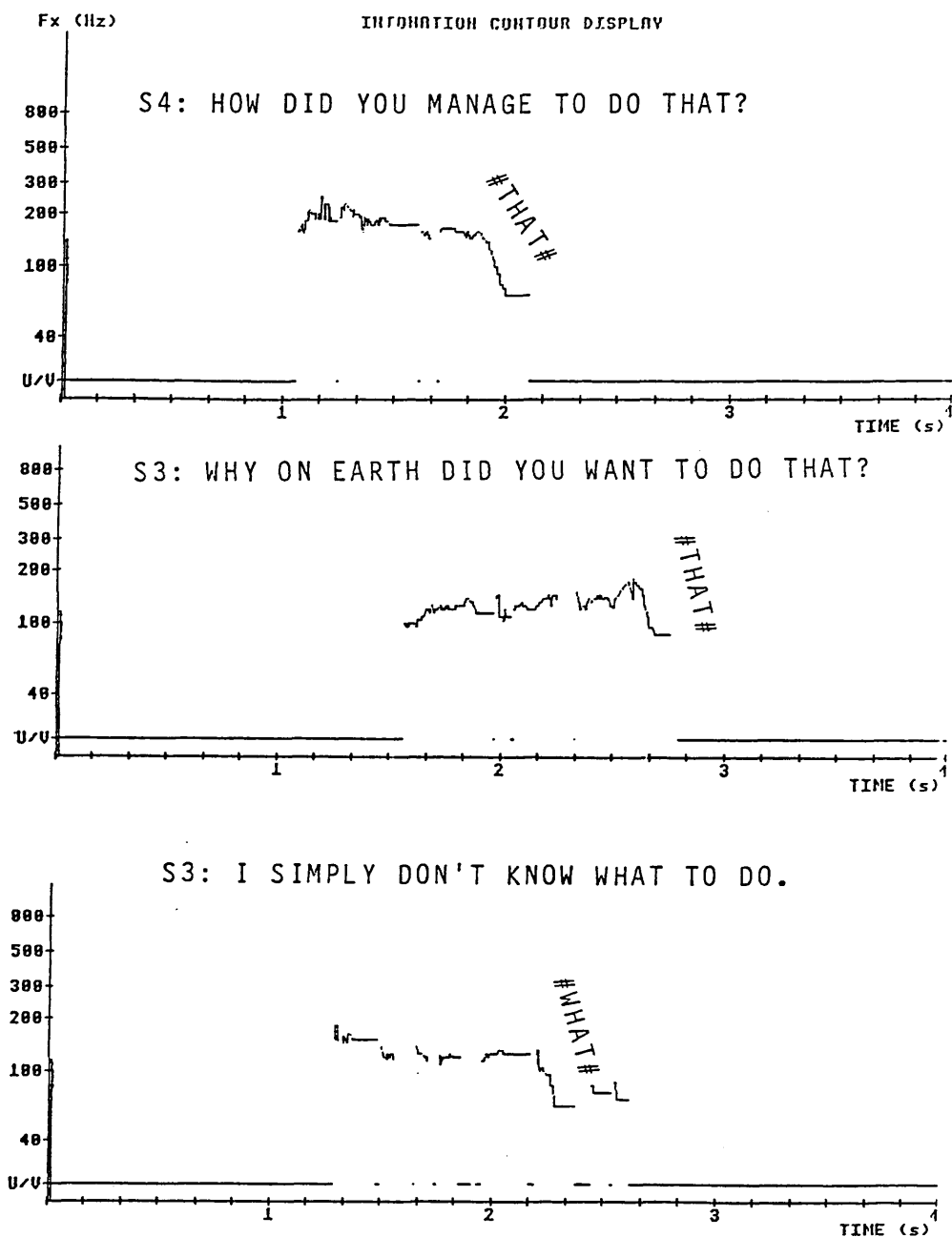


Figure 2: Typical examples of tonic accents occurring only at or towards the end of utterances.

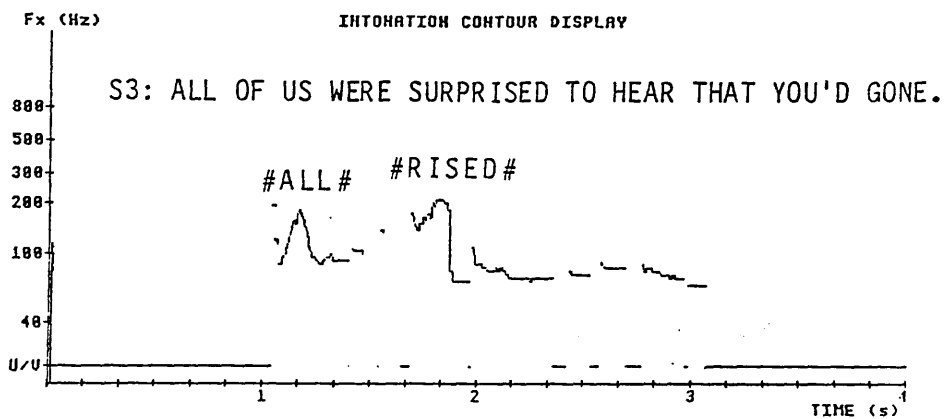


Figure 3: Typical examples of tonic accents occurring only earlier on in the utterance.

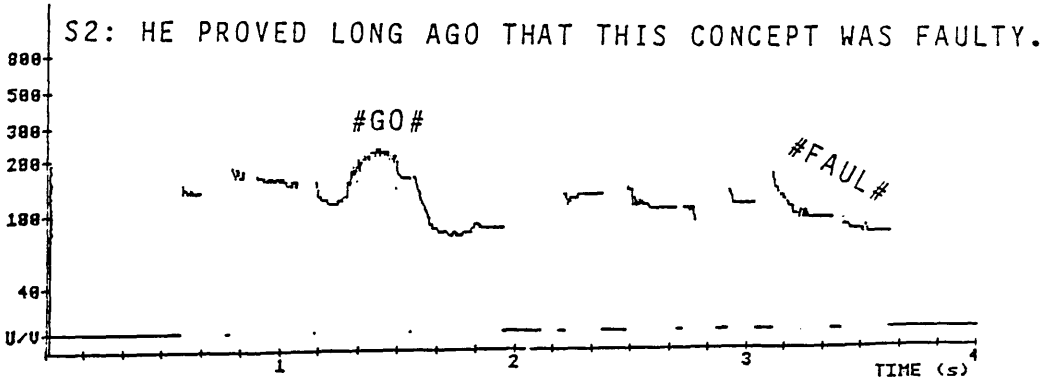
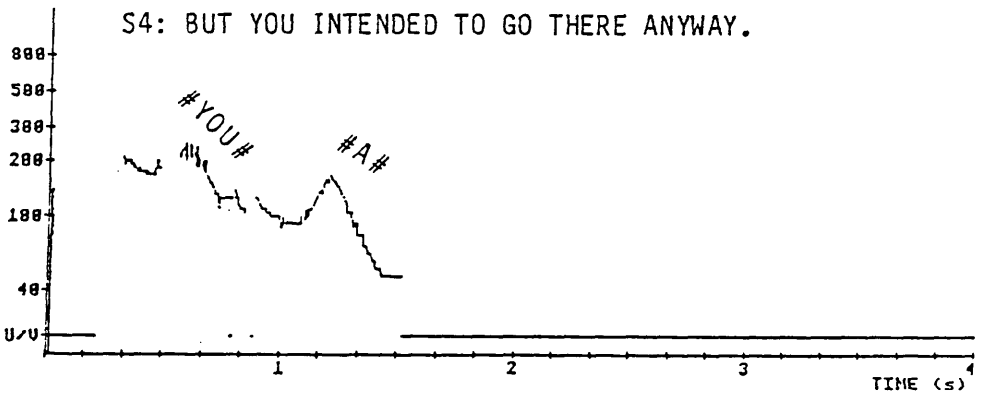
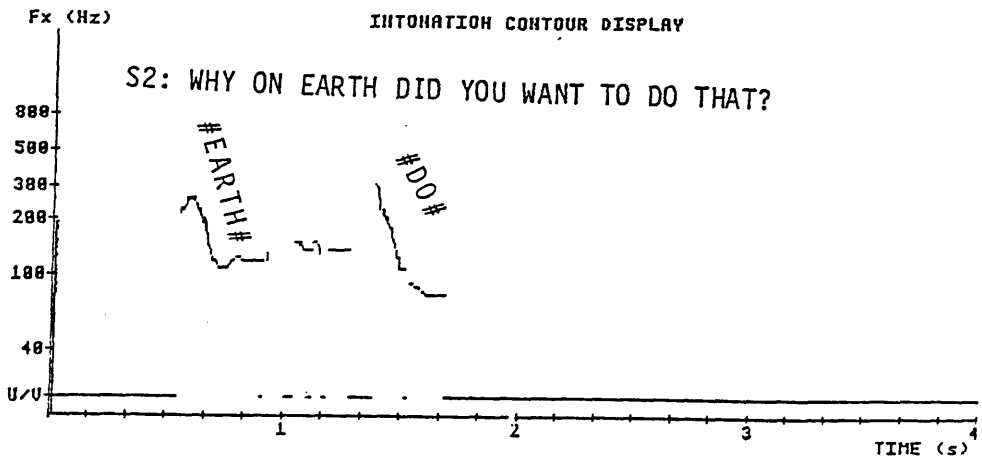


Figure 4: Typical examples of tonic accents occurring both earlier on and towards the end of the utterance.

C. QUALITY

We have already indicated (see page 14) that, though quality is a segment-based feature, it is the quality of the syllabic sounds that counts accentually (accent being a syllable-based feature). When quality is referred to in connection with accent, two aspects of quality can be distinguished:

1. Phonemic quality. This is the type of quality according to which some phonemes (e.g. /ɑ/ or /ɒ/) are regarded as "fuller" (cf. Berger 1955) than others (e.g. /ə/ or /ɪ/). Distinguishing vowel sounds is traditionally decided according to the position of the highest point of the tongue in the three-dimensional space of the oral cavity and according to how rounded the lips are (cf. Ladefoged 1967b:140). The more central a vowel is (in terms of the location of the highest point of the tongue in relation to the tongue itself and to the roof of the mouth across the front-back dimension), the weaker and less likely it is to occur in accented syllables (cf. Gimson 1980:147). Recent empirical research in this respect (Neary 1980) indicates that vowel quality is more related to F1 and F2 of the vowel. To quote Neary:

"...new evidence is provided that indicates that the traditional "height" and "advancement" features are more directly related to the acoustic parameters F1 and F2 than they are to measures of tongue position" (1980:213).

The phonemic aspect of quality shows some correlation with accent on both the intersyllabic (i.e. between one syllable and another) and the intrasyllabic (i.e. between two tokens of the same syllable)

levels. Here are a few examples which show the association of accented syllables with full vowels and unaccented syllables with weak vowels or syllabic consonants:

FATHER	/ˈfɑːðə/
PUBLICIST	/ˈpʌblɪsɪst/
POPULAR	/ˈpɒpjʊlə/
COLONEL	/ˈkɜːnl/

Intrasyllabic variations of phonemic quality can be found in words with stress variants alternating the stress in their early syllables and in root-related words with stress shifts. e.g.

ADULT	/ˈædʌlt/	vs	/əˈdʌlt/
ASPIRANT	/əˈspærərənt/	vs	/ˈæspɪrənt/
DISPUTABLE	/dɪˈspjuːtəbl/	vs	/ˈdɪspjʊtəbl/
NATIONAL	/ˈnæʃənl/	vs	NATIONALITY /ˌnæʃəˈnælɪtɪ/
RELATE	/rɪˈleɪt/	vs	RELATIVE /ˈrelətɪv/
ALLEGE	/əˈledʒ/	vs	ALLEGATION /ˌælɪˈgeɪʃn/

There is reason to justify why the vowels /ə/ , /ɪ/ , and /ʊ/ should be called weak vowels though the last two do occur in accented syllables: where an accent-based phonemic change is required in unaccented syllables, one of this set of vowels is always the alternative as is clear from the examples given above.

2. Allophonic quality. This is the quality according to which the two vowels in the word PITY are said to be different; the one is a full vowel, the other is a weak one (cf. Berger 1955). We examine below the relation of the dichotomy of "stressed" and "unstressed" syllables with that of "full" and "weak" vowels. Let us consider these sets of transcribed words:

A.	B.	C.
/ ₁ æmj <u>ɪ</u> \nɪʃən/	/ ₁ ju <u>n</u> ɪfɪr\kɛɪʃən/	/\k <u>ʊ</u> kərɪ/
/\sɪ <u>s</u> ɪlɪ/	/ ₁ sɪvɪlɪr\zɛɪʃən/	/\sɪtɪzən/

We tentatively believe that underlined syllables in B (shown with secondary accents in the EPD) have vowels that are in terms of quality as full as those of their accented counterparts in C. Vowels in B, in fact, act as frames of reference for their accented counterparts in C and their unaccented counterparts in A. As far as accentual prominence is concerned, vowels in B have an intermediate degree of prominence as compared with their accented and unaccented counterparts. As far as stress as physiological effort is concerned, we assume that they do not receive an intermediate degree. They are rather uttered with physiological effort that is optimal enough for them to occur in what Berger (1955) calls "univocalic moulds" (i.e. monosyllabic one-word utterances). At one extreme, there are the vowels in unaccented syllables that occur as parasitics in the vicinity of accented syllables. At the other, there are the vowels in accented syllables that are not only capable of occurring individually but also of accompanying one unaccented syllable or more. The relation between stress and vowel quality therefore is not one of complete correlation: while the existence of stress entails full vowel quality, lack of stress does not necessarily mean weak quality.

The process by which a vowel like /æ/ in one variant of ADULT, for instance, is changed into /ə/ in the other, or the two tokens of the /ɪ/ in the #SI# of CITIZEN AND CIVILIZATION assume the quality of the second syllable of SICILY is called "vowel reduction" (cf. Dauer 1983; Fudge 1984:193-210; Poldauf 1984:15-17). Lindblom

(1963) introduces the "undershoot" theory to explain the phenomenon of vowel reduction. The theory links the reduction of vowels to their shortening: articulators initially take a route to achieve the full quality of the target vowels but are deflected towards subsequent consonant targets in response to too fast subsequent signals. However, there is evidence to suggest that vowel reduction is not only the outcome of shortened duration. Harris (1978), investigating the acoustic and electromyographic variations of nonsense syllables with varying stress and rate, reports results which support the "extra energy" hypothesis, not the "undershoot" one. According to the former hypothesis, larger signals to the articulators in the case of stress affect both the duration and the formant values of vowels. According to the latter, signals are of the same magnitude. Rakerd et al (1980) report perceptual results that confirm the argument of Harris. They show that "the spectral information for vowels is perceived differently as a function of rate variation and stress variation" (1980:153).

Full vowels and weak vowels are shown by Berger (1955) and Arnold (1956/1957) to occur systematically in words according to their pre-nuclear and post-nuclear positions. Where the regular alternation (as in /ɪg, zæɪˈneɪʃn/), which is very common, is lacking, there can be two syllables with a limit of three with weak vowels between others with full vowels. There can be only one at the beginning of the word and three with a maximum of four at the end of words. Probably because of the overemphasis on the principle of alternation, many syllables with full quality in the EPD were not marked as receiving secondary accent. Here are a few examples with such syllables underlined:

KNOCK- <u>OUT</u>	/ˈnɒkəʊt/
CIRCUM <u>SPECT</u>	/ˈsɜː kəmˌspekt/
FAN <u>F</u> ARONADE	/ˌfænfərəˈnɑː d/
SHOT- <u>GUN</u>	/ˈʃɒtɡʌn/

For a longer list see page 208 ff. On the basis of our durational data of Chapters II and III below (especially Test D, G, L) such syllables would be more consistently marked if included in the category of syllables with secondary accent.

Quality and Sonority

There is another concept namely that of sonority which is often confused with quality as a factor of accent. Jones (1960) defines sonority as the relative degree of audibility of sounds:

"...some sounds are more sonorous than others, that is to say they carry better or can be heard at a greater distance when pronounced with the same length, stress and voice pitch..."(1960:23).

The term "sonority" is often coupled with the term "inherent" (cf. Gimson 1980:224; Jones 1960:247; Ward 1945:156); which could be indicative of what sonority has been actually introduced into phonetics to denote: an invariable phonemic property that decides the relative distinctness of a sound when it occurs in the company of a sequence of sounds. It is, therefore, a principle that governs the phonological structure of syllables and is, as such, independent of phonemic or allophonic quality as a factor of accent.

Several investigators (cf. Delattre 1965; Heffner 1950:74-75; Jespersen 1933:191; Price 1980; Sievers 1901:204-206) have given

similar lists of the hierarchy of speech sounds according to their sonority. Such lists are compatible with the phonemic structure of syllables in individual languages which ranges from the most sonorous phonemes in the syllable nucleus to the less sonorous as far in the syllable margins as their relative sonority would place them. Vowels, therefore, come at the top of the list, then the voiced non-fricative and glide consonants (i.e. /m/, /n/, /l/, /r/, /w/, /j/), then fricatives; then plosives, the voiced consonants being more sonorous than the voiceless ones.

On account of occasionally constituting peaks of sonority, English consonants /m/, /n/ and /l/ are regarded as syllabic sounds (e.g. /^hkɒtn/, /^hmʌdl/, /^hbɒtm/). Not all peaks of sonority, though, are regarded as syllabic. The /p/ in SPORT, for instance, constitutes a drop of sonority between two peaks, yet the word is regarded as a monosyllable. Price (1980) establishes three factors as determinative of the degree of sonority characteristic of a sound: the degree of opening of the vocal tract, the glottal characteristics (e.g. "voice versus hiss") and the rate of change. Price speculates:

"In the acoustic domain, these three factors may correspond to the presence versus absence of a clear formant structure, voice versus hiss (or no) excitation source, and steady state versus transient formant patterns" (1980:330).

Investigating the acoustic correlates of sonority, he finds that duration is a better correlate than amplitude; the latter being effective only when the former is ambiguous.

As a factor of syllabicity, sonority can be neither an accent-determining nor an accent-determined feature; it is a

perceptual category of a different order. It has to be added, though, that sonority is a dimension along which there are items that are variable and items that are not. The variable items are vowels and it is at this point that sonority and quality meet; a full quality vowel that occurs in an accented syllable is bound to be more sonorous than a reduced one in an unaccented syllable. In the final analysis, the unqualified association of sonority and accent (e.g. Ward 1945:156; Gimson 1980:224) should be given up. Were sonority as an interphonemic property really a factor of accent, one would expect the syllables underlined in the examples below to be the ones with primary accent; which is not the case.

INCINERATE /ɪn\ˈsɪnərəɪt/

INSIGHT /\ˈɪnsaɪt/

LUNETTE /luː\ˈnet/

D. DURATION

Durational variations of sounds in English are influenced by the phonetic nature (e.g. voiced vs voiceless) and number of adjacent sounds (cf. Lehiste 1970:19-27; Lehiste 1976; Peterson and Lehiste 1960), speech tempo and the position in the utterance (e.g. pre-pausal or not - cf. Fowler 1977:19-24). These factors just mentioned can be called "non-accentual" since they are not brought about by variations of accentual degrees. Accent-based durational variations are the ones that concern us most in this Sub-section. The relation between duration and accent is an intriguing one. Due to the trading relationships among the four factors of accent (cf. Barry 1981; Boe and Rakotofiringa 1975), we shall consider below the

relation between duration and each of the other three factors, disregarding the potential participation at any given instance of the other factors.

Duration and pitch. Bolinger (1958a/1965:45) maintains that "A pitch obtrusion requires time for its execution". This applies to primary tonic accents that occur at the end of the utterance. In his quest for the relation between vowel duration and the position of the accented syllable within the utterance, Umeda (1975) finds that the durational advantage characterizes not only syllables followed by a physical pause but also syllables that assume the marked pitch movement of a tonic in non-pre-pausal positions. Our results in Test A on the durational variations of the syllables with tonic accent in one-word utterances as a function of position are compatible with those of Umeda. Lehiste (1984) argues that pitch change acts as a cue for accent indirectly; it causes the perception of greater duration which is interpreted, in turn, as accent.

Duration and stress. We refer here to the duration of syllables with primary non-tonic accent. Since the role of pitch prominence is far more limited in this type of accent than in the case of primary tonic accent (see page 16 above), the durational characteristics of non-tonic accent are assumed by us to be mainly the product of stress as extra physiological effort. Results of Test L below show that there are consistent margins of durational difference between syllables with this type of accent and those with secondary accent, though those margins are slightly outside the JND (i.e. the just noticeable difference - see pages 65-66 below on the JND).

Duration and quality. The perceptual prominence characteristic of syllables with secondary accent as compared with unaccented syllables has been found to be reflected in terms of duration. Syllables with the former type of accent have been found to be on average longer by a margin that is within the threshold of perception. This difference can be mainly attributed to the fact that the nuclei of syllables with the former type of accent are full vowels while those of the latter are reduced vowels. We referred above (see page 58 ff) to some pieces of evidence that quality-based durational variations are achieved by commands of different magnitudes to the articulators rather than to the "undershooting" of some in a series of equal commands. Those pieces of evidence, though, are based on comparisons of accented (i.e. with primary accent) and unaccented syllables and we are aware of no evidence to the same effect with regard to comparisons of syllables with secondary accent and unaccented ones.

The relations postulated above between duration and other factors of accent would seem to suggest the dependence of duration on those other factors. There are though various pieces of evidence that duration is an independent variable. Berkovits (1984) finds that duration is not directly proportional to F_0 change in Hebrew as is the case in English with regard to accented final syllables. Lehiste (1970:36, 1976) reports that the durational advantage of accented syllables in Czech, Estonian and Finnish as compared with unaccented ones is minimal. Vaissière (1983), investigating language-independent prosodic features, reports the physical parameters of accent to be in a more systematic correlation with each other in English than in French. A similar finding for English

and Japanese respectively is reached in Beckman's 1986 book: Stress and Non-Stress Accent (1986:145-178). Comparing the durational behaviour of accented and unaccented vowels in what he calls "dominant" and "non-dominant" (i.e. with tonic and non-tonic primary accents respectively according to our terminology) words in Dutch, as another stress-accent language, Nootboom (1972: 61) concludes that "...the effect of stress on duration is largely independent of the pitch accent". The pieces of evidence just cited show conclusively that, since accent-based durational variations are language-specific, they are independent from the point of view of production from other factors of accent.

The relation between accent and duration is commonly put in the form of the simple statement that accented syllables are longer than unaccented ones (cf. Parmenter and Trevino 1935; Lehiste 1970:36-40; Lehiste 1977). This statement poses a question: do we, in our judgement of accent, base it on comparisons of the durations of adjacent syllables or on comparisons of the durations of syllables with their own abstract norms of duration? Along with Couper-Kuhlen (1986:22-23), we believe the latter alternative is a more plausible one since it excludes the effect of intrinsic durational differences of different vowel phonemes. For this reason we have kept the syntagmatic and paradigmatic structure of syllables compared as a constant factor as far as applicable in our detailed study of syllable-durations in Chapters II and III.

In studying syllable-duration in detail in those two Chapters there are some underlying aims which can be summed up as follows:

- i. To establish durational relations among syllables with different accentual degrees (i.e. primary-tonic, primary non-tonic,

non-primary unreduced or secondary accent, and non-primary reduced or unaccented). In doing so we want to carry the investigation of the relation between accent and duration a stage further since studies in this respect we are aware of used to investigate the categorical distinction of accented and unaccented syllables only.

- ii To study the factors that modulate or override the accent based durational variations (e.g. syllable-position).
- iii To study how the special prominence of appositional phrases is achieved. This is hoped to throw some light on the nature of accentual prominence itself.
- iv To study the durational relations between accented and unaccented syllables at different speech-rates.
- v To study the durational stability and/or instability of syllables in one-word and longer utterances. This is hoped to confirm or refute the distinction of so-called "word-accent" and "sentence-accent".
- vi To study the consistency of EPD marking of given degrees of accent.

Comparisons of absolute durations of syllables have been resorted to in our study of the relation of accent and duration. It would probably have been preferable to have compared them with relative durations of syllables with different syntagmatic and paradigmatic structures. This is no doubt beyond the scope of a study of this kind. We have used the value 40 msec as the criterion against which to check how significant the average margins of difference are between categories of syllables compared. Lehiste (1970:13) reports the JND (i.e. the just noticeable difference in duration) to range from 10 to 40 msec for speech sounds that usually

lie from 30 to 300 msec in length. We have used the maximum value since our comparisons are mostly of syllable-durations not durations of sounds. Besides, Nooteboom (1972:18-19) reports standard deviations of the range of 10-15 msec in repetitions of the same phrase for the durations of syllables. These deviations are accounted for by Nooteboom in these words:

"We may assume that in repeating the same phrase the same articulatory programme is realised over and over again and that the fluctuations found in the measurable durations are due to innaccuracies in the measurements, fluctuations in the production processes and perhaps minor fluctuations in the stored programme" (1972:19).

Chapter II

Word-Accent in One-Word Utterances

Introduction

This Chapter investigates the relationship between syllable-duration and the different types of accent a given syllable receives. It deals mostly with that relationship in individual words (as distinct from longer utterances). Where appropriate, though, arguments have had to be extended to include that relationship in longer utterances (as in Tests B and G for instance).

The approach of this study is analytical rather than synthetic since the objective of the study is not to investigate the extent to which duration is important in the perception of accent, but to find out how far the phonological feature "accent" is reflected by syllable-duration in reading lists of words and sentences aloud. The speech material analysed was not, therefore, restricted to minimal pairs as is the case in many experiments of the acoustic correlates of accent (e.g. Fry 1955, 1958, 1965; Bolinger 1958a; Isenberg and Gay 1978).

The method adopted in the study is that of comparison of the duration of target syllables. The syllables compared were mostly of identical syntagmatic and paradigmatic structure (e.g. MENTAL vs MENTALITY, ARTIST vs ARTIFICIAL - where the syllables compared are the ones underlined). By conforming to this condition as far as applicable, we are able to avoid confusing durational variations due to different syllable weights with those due to different accentual types. A related condition was that of syllable-position within the word (i.e. word-initial, word-medial, and word-final). Word-medial

syllables were occasionally considered in terms of order of occurrence within the word (i.e. second, third,...etc) as in Test A.

Limitations:

Building sizeable lists of words for comparison under these two conditions was a difficult task if we take into account the third varying condition of accentual types under investigation in each specific Test. This accounts for the fact that where those conditions are operative, the lists are small as in most Tests in this Chapter. Occasionally, one of these two conditions or both had to be abandoned. The syllable-position condition is, for instance, abandoned, in part, in Test D because syllable-position itself is treated as a variable in that Test. It is abandoned, in part, as well in Test G because of the rarity of accentual variation under investigation in syllables of the same syllable-position. In Test B, both conditions had to be abandoned as being totally inapplicable.

An unavoidable limitation of the study is that of speech-rate. Though on introducing the informants to the task required from them, they were requested to keep to their normal speech-rate unless instructed otherwise (as in Test I), slight changes in rate cannot be ruled out. Indeed there are in each Test, adverse cases which are presumably due to potential changes in speech-rate. Since margins of durational difference have been found to support the hypotheses underlying each individual Test, the effect of potential changes in rate should not, however, be overemphasized.

The Material

Words for each Test were selected mostly from the EPD. Besides satisfying the conditions referred to above, the selection was based upon the variables investigated in each Test. The written text from which the informants were to read was not organized on a Test-by-Test basis. Words and sentences of various Tests were randomly distributed over the space of 14 pages (Appendix 2). By this random distribution, two aims were envisaged:

1. Not to let the informants be aware of the specific aim of each Test, which could have led to contrasting the items compared or any similar unwanted artifact.
2. Small chunks of word and sentence lists were made to alternate to avoid monotony for the informants as well as persistent patterns of delivery that are likely to ensue in long lists of words or sentences only.

Instructions to the Informants

The list of words and sentences and a set of instructions (Appendix 1) were given to the informants three days before the recording. We assumed that the informants' prior reading of the material would help them to be familiar with it, and with the task required from them. In the instructions that accompanied the list our aims were as follows:

i - A broad indication of the aim of the experiment (i.e. "to study a particular aspect of English pronunciation") was made to avoid possible thoughts on the part of the informants that their pronunciation was to be judged in terms of how "correct" it was.

ii - The informants were asked to stick to the speech-rate that suited them throughout the recording of the material. This request was made with the hope of minimizing the effect of the interference of speech-rate change with the effect of the variables under investigation.

iii - They were asked to approach each word afresh with the hope of avoiding any repetitive patterns of delivery.

iv - It was clearly indicated to the informants that they were free to say words and sentences again if they were not satisfied with the way they pronounced them. This was meant to reduce the amount of data that would have to be removed from the calculations due to mispronunciations. There were many cases in which the informants acted upon this instruction, and there were few cases in which they failed to do so (e.g. MENDING by S1 is removed in Test K).

Informants:

Four male native speakers of English recorded the material. Since this study is concerned with the durational manifestations of accent as a phonological feature of English, we did not seek to control the variety of English under investigation. The Table below provides the relevant details of each speaker. The informants are identified as S1, S2, S3, and S4 in the Table and henceforth throughout the thesis.

Informant	Age at time of record- ing	Primary/ Secondary Education	University Education in	Sort of Pre- university education	Variety of English as described by the informant himself
S1	65	London	Oxford	Private & State	London with Midland influences
S2	31	Surrey	London & Oxford	Private & State	Southern
S3	51	Glasgow	Glasgow & Oxford	Private & State	R.P. with Scottish traces
S4	47	Sussex	Cambridge	State	R.P.

The information in this Table was obtained by means of a questionnaire (Appendix 3).

As the identification of given varieties of speech cannot be formulated on an "objectifiable" basis (Wells 1982: 280), we can only say that three out of the four informants (S1, S2, S4) have been brought up in the regional base - at least historically - of the so-called Received Pronunciation or R.P. (Gimson 1980: 88-89), namely the south east of England. It is significant that informants S3 and S4 used the term R.P. to describe their own variety of English speech, which indicates an awareness of linguistic terminology. S1 and S2, who are professional linguists, described their variety of speech as "London" and "Southern" respectively. Refraining from the use of the term R.P., they undoubtedly preferred the less specific descriptions of "London" and "Southern" to allow for non-R.P. influences.

Recording the Material:

The material was recorded in a sound-proof room in the Audio-Visual Centre of the University of Glasgow. This was done by a NAGRA-IV S tape-recorder on AGFA PEM 369 PROFESSIONAL tapes, with the microphone 18 inches away from the informant.

Four informants recorded the material initially. It was decided to replace one of the informants by another (S2). The informant excluded was required, being a professional phonetician, to record the material for the Perception Test described in Chapter IV below, where he was capable of achieving the accentual manipulations specified.

Analysis Procedures:

In this Section we shall describe the following:

- (i) The equipment used in the analysis of the material.
- (ii) Syllabification conventions adopted.
- (iii) Conventions adopted in calculating syllable-duration and segment-duration (Test B only).
- (iv) The method adopted for the statistical analysis of results .

(i) Equipment:

The material was analysed acoustically using a Kay Spectrum Analyser 7029A in the Phonetics Laboratory of the University of Glasgow. As the major concern of the study is with durational aspects, wide-band spectrograms with a frequency resolution of 300 Hz were made. Although wide-band spectrograms do not provide such accurate information about the frequency value of items in the spectrum as narrow-band spectrograms do, their value lies in the accuracy with which durational features of an utterance can be

calculated (cf. Fry 1979: 100-103). The recorded material was played into the spectrograph via a UHER 4000 REPORT-L tape-recorder.

(ii) Syllabification

Since the comparison of syllable-durations is the main preoccupation of the study, consistent adherence to a given set of rules of syllabification throughout has been of paramount importance. Before spelling out these rules, it is relevant to touch upon the theories offered in the literature on the definition of the syllable. Stetson (1951: 2) advanced the chest-pulse theory. According to this theory, the syllable is a movement of the pulmonic air-stream mechanism. In other words, each chest-pulse corresponds to a syllable. Subsequent physiological research (Ladefoged 1967a: 70) shows that there were adverse cases (disyllabic words produced by one peak of muscular activity (e.g. PITY, AROUND) and monosyllabic words spanned by two peaks (e.g. SPORT, STAY) where the chest-pulses were not a good correlate of syllabicity. Price (1980) maintains that syllabicity is a correlate of "prominence" or "sonority"; the syllable nucleus, mostly a vowel, is the most sonorant or prominent segment in the syllable and segments forming the margins of the syllable are less sonorous the farther they are from the nucleus. However, sonority, alone, cannot explain why a word like SPEAK is regarded as a monosyllable while the /s/ is known to be more sonorous than the /p/ (Ladefoged 1982: 222).

There is so far no theory of the syllable which does not involve such instances of inadequacy. This situation leads Ladefoged (1982:223-224) to speculate that syllables may be "abstract

units that exist at some higher level in the mental activity of the speaker". Support for this speculation, as he further argues, comes from the field of slips of the tongue where the commonest type of consonantal errors involves substituting syllable-initial and syllable-final consonants for target consonants with the same positions in their respective syllables.

Since there appears to be no entirely satisfactory definition of the syllable, we have at least to be contented with the notion of the syllable even if the concept itself cannot be fully elucidated. Syllabification of the material under investigation has been guided by the following principles:

I. An intervocalic consonant belongs to the following rather than the preceding syllable (O'Connor and Trim 1953).

e.g. PO#LICE, PRO#CESS, VER#SI#FI#CA#TION, SPE#CI#FY,
PRE#SSURE, AR#TI#FI#CIAL.

II. A syllabic consonant and the preceding consonant are regarded as belonging to the same syllable if they are both part of the same word.

e.g. MI#DDLE /mɪdl/ , PER#SON /pɜ:sn/ .

Contracted NOT and WILL (i.e. N'T and 'LL respectively), on the other hand, are treated as syllables on their own where the /n/ and /l/ are syllabic.

III. In morphemes of some semantic significance (e.g. "MIS" in "MISUNDERSTAND", the post vocalic consonant is treated as the coda for the preceding syllable rather than the onset for the following consonant as principle I, above, would entail.

IV. Conversely, morphemes with syntactic functions (e.g. the "ING" in WITHSTANDING or MENDING) are not treated as syllables on their

own but have as their onsets the preceding consonant, in accordance with principle I.

V. An intervocalic consonant cluster is in most cases divided into a coda for the preceding syllable and an onset for the following one.

e.g. MEN#TALITY, DEFEC#TIVE, FUL#FIL, DIFFICUL#TIES,
MISUN#DERSTAND, CON#SIDERED, IN#JEC#TION,
FUN#DAMEN#TALS.

As an exception to this principle, where the intervocalic cluster is phonologically possible in a word-initial position, then it was, as a whole, regarded as an onset for the following syllable.

e.g. POR#TRAIT, PRO#GRESS, CHEMI#STRY, ADE#QUATE.

Similarly, in the case of clusters of more than two phonemes the syllable boundary was assumed to occur before a sequence of phonemes that is phonologically possible in word-initial positions.

e.g. ELEC#TROCHEMISTRY, FIL#TRATION.

VI. Where in the actual utterance of a given informant a vowel is elided in a CV syllable (since that was the only syllable type where vowel elision occurred in the material), the consonant is regarded as part of the preceding syllable.

e.g. CHARACTERISTIC#ALLY (where the underlined vowel is the one elided).

(iii) Calculation of Syllable- Durations:

Each spectrogram measured 319mm in length representing 2.4 seconds of signal. Thus 1mm = 7.5235 milli-seconds (msec). This was adjusted in our calculation of syllable-durations to: 1mm = 7.5 msec. Syllable length on the spectrograms was calculated to the nearest 0.25mm. Fractions of a milli-second in syllable durations were neglected. This in no way obviates the well-known difficulty of segmenting sound spectrograms.

(iv) The Method Adopted for theStatistical Analysis of Results :

Discussion of the results throughout the thesis has been based on mean values of margins of durational differences or of syllable-durations. Appendices Qi and Qii (page 429b), however, provide two examples of an alternative statistical analysis , using standard deviation and standard scores.

Test A

The Position of the Tonic in One-Word Utterances

In designing this Test, two Sets of word-pairs were selected from the EPD on the following basis:

(i) In the First Set (Table Ai), the two target syllables in each pair, identical in terms of syntagmatic and paradigmatic structure, were also identical in terms of the syllable order within the word (i.e. word-first, word-second...etc - e.g. TYPOGRAPHIC vs PHOTOGRAPHIC, where the target syllables are the ones underlined).

(ii) In the Second Set (Table Aii), the two target syllables in each pair differed from their counterparts in the First Set in that they were not of identical syllable order within their respective words. In each pair, where the target syllable in one word was, say, word-first or word-second, in the other it was word-second or word-third, or word-third or word-fourth respectively. In short, where in the one it was "early" in terms of order from left to right, in the other it was comparatively "late" (e.g. DEPENDENCE vs INTERDEPENDENCE). Words with "early" accented syllables were considered in a separate group and those with "late" accent in another. Target syllables in both sets of the Test had something in common, namely that they were all marked in the EPD as receiving primary accents. Since the material investigated in this Test comprised one-word utterances only with no contrast or any such contextual effects being operative, these primary accents were regarded as tonic ones.

For the sake of practicability in selecting the word-pair lists in this Test, we had to tolerate the difference in the preceding and

following phonemic environments, if any, of the two tokens of each target syllable (compare, for instance, PENTAMETER vs MENTALITY where the items underlined are the syllable-tokens compared). In some cases, though, this difference was eliminated (compare, for instance, VERSIFICATION vs MORTIFICATION).

In designing this Test, it was hypothesized that in the First Set where the Target syllable tokens were identical in terms of the syllable order, there would be no significant margins of difference in favour of one group or the other. Needless to say, that assigning a word to the left or right hand group in this Set (see Table Ai) was done on a random basis. As far as the Second Set was concerned, two contradictory hypotheses were envisaged:

(1) That final-lengthing (cf. Fowler 1977: 19-20) might be operative in non-word-final syllables as well as in word-final ones causing the "late" syllables to be longer than the "earlier" syllables. If this were the case, there would be a greater average margin of difference between the two groups of target syllables in the Second Set than the potential one in the First Set.

(2) That the results would replicate for English Nooteboom's (1972: 64-67) results for Dutch in this respect, namely that while the vowels of word-final syllables were found to reveal durational variations that were inversely proportional to the number of preceding syllables, vowels of word-medial syllables were found to reveal no such variations. Durational variations of syllables only were considered in this Test.

The results of the Test were as follows:

I. In the 56 cases of comparison constituting the First Set, 30 right hand tokens were found to be longer than their left-hand

counterparts averaging 34 msec. In the remaining 26 cases, right hand tokens were found to be shorter than their counterparts coincidentally averaging 34 msec as well. These results suggest the validity of the hypothesis above concerning this Set that on average only inconsequential margins of difference should exist between the two groups of syllable-tokens compared. Such margins did not even exist.

II. In the 44 cases of comparison constituting the Second Set, 20 tokens with late tonic accents were found to be longer than their counterparts with earlier ones averaging a 29 msec margin of difference. In the remaining 24 cases, the tokens with late tonic accents were found to be shorter than their counterparts with earlier accents coincidentally, again, averaging a 29 msec margin of difference. The results of cases of comparison constituting this Set as such support hypothesis 2, rather than 1, above that as in the First Set there would be no significant margins of difference. The fact that the number of tokens with late accent is relatively greater where they are shorter than where they are longer (24 vs 20) further discounts hypothesis 1.

Word	Word	S1	S2	S3	S4
<u>TYPOGRAPHIC</u>	<u>PHOTOGRAPHIC</u>	< 1	< 2	< 26	> 35
<u>PENTAMETER</u>	<u>MENTALITY</u>	< 39	< 31	> 5	> 21
<u>MENTALITY</u>	<u>TOTALITY</u>	< 61	> 25	< 36	> 17
<u>PENCIL</u>	<u>PENSIONER</u>	> 23	> 12	> 38	> 69
<u>HARMFUL</u>	<u>HARMLESS</u>	< 74	< 94	< 58	> 56
<u>VERSIFICATION</u>	<u>MORTIFICATION</u>	> 31	< 2	> 18	> 17
<u>STANDSTILL</u>	<u>STAND UP</u>	> 11	< 6	> 21	< 10
<u>SCHOOL-BOY</u>	<u>SCHOOL-GIRL</u>	> 70	< 15	> 6	> 67
<u>MILITANT</u>	<u>MINUTING</u>	< 50	< 29	< 36	> 3
<u>ARCHITECT</u>	<u>ARTIST</u>	< 20	< 61	< 26	< 35
<u>MIMICRY</u>	<u>MINI</u>	> 24	< 69	< 23	> 35
<u>COMPREHEND</u>	<u>REPREHEND</u>	<106	>162	< 22	> 23
<u>SENDING</u>	<u>SENTIMENT</u>	> 13	< 81	< 13	> 73
<u>SICILY</u>	<u>SILICA</u>	> 25	< 2	< 10	< 4

TABLE Ai: Margins of durational difference between accented syllables with identical order in their respective words.

Word	Word	S1	S2	S3	S4
DE <u>P</u> ENDENCE	INTERDE <u>P</u> ENDENCE	> 4	> 24	> 32	< 17
WITH <u>S</u> TANDING	UNDER <u>S</u> TANDABLE	> 46	> 15	> 7	> 66
<u>M</u> ENTAL	FUNDAM <u>E</u> TAL	>110	> 29	> 43	< 31
SIZE <u>A</u> BILITY	AVOIDAB <u>I</u> LITY	> 40	> 4	< 26	< 24
<u>A</u> VALANCHE	ARTIFICI <u>A</u> LITY	< 7	< 7	< 25	< 7
DIM <u>E</u> NSIONS	SENTIMENT <u>A</u> LITY	> 4	> 20	< 12	> 38
FANT <u>A</u> SIA	CONSULT <u>A</u> TION	< 4	> 34	> 75	< 16
SENTIMENT <u>A</u> LITY	MULTIDIM <u>E</u> NSIONAL	> 15	> 11	> 3	< 38
<u>A</u> CHING	PRONUNCI <u>A</u> TION	< 23	<109	< 53	< 43
MEDI <u>A</u> TION	PRONUNCI <u>A</u> TION	> 32	< 32	> 1	> 22
GUST <u>A</u> TION	CONSULT <u>A</u> TION	< 19	< 57	> 36	< 38

TABLE Aii: Margins of durational difference between accented syllables with different order in their respective words.

Test B

Tonic and Non-tonic in the Same Word

This Test comprises a number of words each of which is pronounced individually and some of which are embedded in sentences. The words of the Test are chosen on the basis that they are shown in the EPD with a variant that has two primary accents (see Tables Bi and Bii for examples of such words).

The objectives of the Test are:

- (i) to establish the durational relations between the tonic and non-tonic (lexicographically rather than contextually) in this type of word.
- (ii) to investigate the potential durational variations of those syllables occasionally shown in pronouncing dictionaries (e.g. the EPD) with two primary accents from one-word utterances to longer ones.

Margins of durational differences between each tonic syllable and its non-tonic counterpart were calculated and set out in Tables Bi and Bii for one-word utterances and longer utterances respectively. The sign < is added to the left of figures where the tonic (lexicographically) is longer than the non-tonic. The sign > is used where it is shorter. Where the sign * appears, it indicates that one of the two values compared - always that of the non-tonic syllable - is not inclusive of the closure phase of a word-initial plosive.

In designing this Test, the following hypotheses were envisaged:

1. In one-word utterances, as the words are uttered in no context, the tonic accent would be received by the syllable that

Word	S1 Syl. Vowel		S2 Syl. Vowel		S3 Syl. Vowel		S4 Syl. Vowel	
<u>NON-STOP</u>	<133	< 43	< 75	< 60	<141	< 23	< 78	< 10
<u>UN COMFORTABLE</u>	< 90	<u>> 22</u>	< 88	< 6	<108	0	<112	<u>> 8</u>
<u>ELECTROCHEMISTRY</u>	< 57	< 4	<u>> 2</u>	<u>> 4</u>	< 28	<u>> 9</u>	<u>> 14</u>	<u>> 28</u>
<u>UNPATRIOTIC</u>	<u>> 32</u>	< 41	<u>> 78</u>	<u>> 34</u>	<u>> 35</u>	< 30	<u>> 84</u>	<u>> 36</u>
<u>DIS CREDIT</u>	*	*	*		*	*	*	*
	<u>> 6</u>	< 22	< 84	0	< 32	< 30	< 34	< 26
<u>CO-EXIST</u>	*	*	*	*	*	*	*	*
	<243	< 17	<301	< 26	<209	< 62	<195	< 21

MULTIDIMENSIONAL < 25 > 24 < 43 < 9 < 7 > 17 0 > 15

TABLE Bi: Margins of durational differences in msec between tonics and non-tonics in one-word utterances. (*One of the two syllables compared starts with a plosive the closure phase of which is not included in the comparison. Values underlined are those where tonics are shorter.)

Word	S1 Syl. Vowel		S2 Syl. Vowel		S3 Syl. Vowel		S4 Syl. Vowel	
<u>NON-STOP</u>	<132	< 24	< 84	< 18	< 2	<u>> 4</u>	< 49	0
<u>UN COMFORTABLE</u>	< 47	<u>> 36</u>	< 28	<u>> 20</u>	< 64	< 6	<u>> 4</u>	<u>> 38</u>
<u>ELECTROCHEMISTRY</u>	> 1	0	<u>> 55</u>	<u>> 17</u>	< 1	<u>> 15</u>	<u>> 47</u>	<u>> 47</u>
<u>IMPERCEPTIBILITY</u>	<u>> 58</u>	<u>> 43</u>	<u>> 50</u>	<u>> 31</u>	<u>> 20</u>	<u>> 18</u>	> 2	0

TABLE Bii: Margins of durational differences in msec between tonics and non-tonics in longer utterances. (Underlining as in Table Bi.)

Average	One-word utterances	Longer utterances
average difference of vowel-duration (tonic vowel being longer)	26	16
average difference of syllable-duration (tonic syllable being longer)	75	45
average difference of syllable-duration (tonic syllable being shorter)	40	38
average difference of vowel-duration (tonic vowel being shorter)	19	31

TABLE Biii: Average durations in msec of one-word and longer utterance tokens of tonic vowels and syllables.

lexicographically receives the primary accent if only one syllable is shown to do (e.g. UN`COMFORTABLE). Consequently such a syllable would be more likely to be longer than the one that is shown with a primary accent only when two are shown (e.g. ^lUN`COMFORTABLE).

2. That syllables only rarely shown lexicographically with a primary accent would be more probable to outweigh the usual tonic in terms of prominence in some longer utterances on account of contrast. Consequently, such syllables were expected to prove longer than

their tonic counterparts.

Word	S1		S2		S3		S4	
	non- tonic	tonic	non- tonic	tonic	non- tonic	tonic	non- tonic	tonic
NON-STOP	> 7	> 8	> 32	> 23	< 56	> 83	< 5	> 24
UN COMFORTABLE	> 14	> 59	< 39	> 21	< 26	> 18	< 63	> 53
ELECTROCHEMISTRY	> 7	> 65	< 32	> 21	> 20	> 47	> 4	> 37

TABLE Biv:Margins of durational differences in msec between the tonic and non-tonic tokens of syllables in longer utterances as compared with their counterparts in one-word utterances.
(Underlining as in Table Bi.)

3. Vowel nuclei were expected to show comparable degrees of consistency to accent-based syllable-duration variations. Hence, the durations of the vowel nuclei of target syllables were also calculated and included in Tables Bi and Bii above.

The results of the Test can be summed up as follows:

1. Compared to vowel-duration, syllable-duration difference between the pairs of target syllables in one-word utterances and in longer utterances is a more consistent and significant one. See Table Biii for a summary of average vowel- and syllable-duration differences. In most cases of comparison, the tonic syllable in one-word utterances is found to be longer than the non-tonic; the average durational difference being 75 msec. The rare cases where the tonic

is found to be shorter average only 40 msec, and in fact all those cases can be ascribed to the fact that the tonic in those cases is of a less heavy syntagmatic structure (CV vs CVC in ELECTROCHEMISTRY, and V vs VC in UNPATRIOTIC).

2. Vowel-duration shows some degree of correlation to syllable-duration variation, yet it is by no means consistent in that correlation. Where tonic syllables in one-word utterances are longer, their vowel nuclei are mostly longer, but whereas tonic syllable-durations average a difference of 75 msec longer, vocalic nuclei average only 26 msec. Tables Biii and Biv show that there are those cases where tonic vowel nuclei are shorter, yet their respective syllables are longer and vice versa (see, for instance, UNCOMFORTABLE for S1, and UNPATRIOTIC for S3). In the light of those facts, hypothesis 3 set forth above about vowel nuclei being expected to show comparable degrees of consistency to accent-based syllable-duration variations is not confirmed.

3. In longer utterances, the number of cases where the tonic (lexicographically) is shorter than its opposite non-tonic comes to about 43% (Table Bii). This could be seen as lending support to hypothesis 2 set forth above with regard to the probable capability of the lexicographical non-tonic to be longer than the lexicographical tonic, especially in utterances with contrastive contexts. Furthermore, in those cases where the tonic is not shorter than the non-tonic, the average durational difference drops from 75 msec (in one-word utterances) to 45 msec (in longer utterances where there is contrast). This could be interpreted in terms of a potential tendency to reduce the margin of durational difference between the tonic syllables (lexicographically) on the

one hand and their non-tonic counterparts (lexicographically) on the other.

In Table Biv, the target tonics and non-tonics of longer utterances are being compared with their own tokens in one-word utterances. All tonics are found to be shorter in longer utterances than in words. 50% of non-tonics are longer. Whereas tonics are on average 38 msec shorter, non-tonics with reduced duration are on average only 13 msec shorter, and those with lengthened duration are 36 msec longer. All these facts further support hypothesis 2 above that non-tonics (lexicographically) can assume the durational advantage of tonics in longer utterances with contrastive contexts.

Test C

Primary and Non-primary Unreduced Accent

In designing this Test, a number of word-pairs were chosen from the EPD. Each pair had in common a syllable with the same syntagmatic and paradigmatic structure and the same syllable-position within the word (all being word-initial). In one case only, two of the informants (S1 and S3) did not conform to the layout in that they produced the first syllable in COMBAT as /kʌm/ rather than /kɒm/ thus making it syntagmatically different from its counterpart in COMBINATION. The difference within each pair is that one token of the target syllable is lexicographically shown with a primary accent, in the other with a secondary (or non-primary unreduced) accent. Actual syllable-durations are shown in Appendix C and durational differences based on that Appendix are shown in Table C where the syllables with secondary accent are shown to be either shorter or longer than their counterparts with primary accents.

The aim of the Test was to find out to what extent the lexicographical classification of accents into primary and secondary would be reflected by duration; that is to say whether the syllables with primary accents would be consistently longer and, if so, what the average durational difference might be. It would certainly be significant to compare an average durational difference in this case (i.e. between syllables with primary accents and syllables with secondary accents) and a potential difference that might exist in the next Test (Test D) where syllables with primary accents are compared with unaccented syllables.

The results show that 85% of syllables with primary accent are longer than their counterparts with secondary accent and they average a durational difference of 40 msec approximately (i.e. just within the JND). Only in 15% of cases is the syllable with secondary accent found to be longer than its counterpart and one third of these cases happen to be in the pair FULL-LENGTH vs FULLNESS. The average durational difference in those rare cases where the syllables with secondary accents are found to be longer than their counterparts is 29 msec. Thus accented syllables in one-word utterances are mostly longer than syllables with secondary accents.

Words	S1	S2	S3	S4
<u>SPECIFY</u> - <u>SPECIFICATION</u>	> 22	> 12	> 84	> 21
<u>MILITANT</u> - <u>MILITARIZATION</u>	> 48	> 38	> 39	> 7
<u>CATEGORY</u> - <u>CATASTROPHIC</u>	> 47	> 3	> 42	> 17
<u>FUNDAMENT</u> - <u>FUNDAMENTAL</u>	> 48	< <u>33</u>	> 14	> 1
<u>COMBAT</u> - <u>COMBINATION</u>	> 55	< <u>1</u>	> 70	> 26
<u>FULLNESS</u> - <u>FULL-LENGTH</u>	< <u>54</u>	> 40	< <u>12</u>	< <u>45</u>
<u>MEDIATE</u> - <u>MEDIATION</u>	> 27	> 26	> 59	< <u>18</u>
<u>COMMUNICATE</u> - <u>COMMUNICATION</u>	> 48	> 34	> 25	> 47
<u>MORTIFY</u> - <u>MORTIFICATION</u>	> 35	> 14	> 25	> 47
<u>PERSONAL</u> - <u>PERSEVERE</u>	> 13	> 38	< <u>5</u>	> 4
<u>ARTIST</u> - <u>ARTIFICIALITY</u>	> 50	> 57	> 47	> 37
<u>TYPIST</u> - <u>TYPOGRAPHIC</u>	> 25	> 28	> 38	> 21
<u>PHOTOGRAPH</u> - <u>PHOTOGRAPHIC</u>	> 56	< <u>9</u>	> 22	> 21
<u>VARY</u> - <u>VARIABILITY</u>	< <u>89</u>	> 216	> 88	> 92
<u>CURATE</u> - <u>CURATOR</u>	> 27	> 78	> 59	> 55

TABLE C: Margins of durational differences in msec between syllables with secondary accent and their counterparts with primary accent. (Values underlined are those adverse cases of syllables with secondary accent being longer than their counterparts with primary accent).

Test D

Accented and EPD Unaccented Syllables

The comparison that is being made in this Test is between the duration of accented syllables on the one hand and that of unaccented syllables on the other. Three Sets of word-pairs have been derived from the EPD corpus of words on the following basis:

(1) In the First Set, syllable-positions of the two tokens of the target syllable are the same (i.e. word-initial or word-final).

(2) In the Second Set, like the First, syllable-positions are also the same. Whereas unaccented syllable-tokens in the First Set are regarded by us as rightly classified in the EPD: their counterparts in the Second Set belong to that category of syllables we regard as receiving secondary-like accents (see Tests I, G and L for further details).

(3) In the Third Set, all the unaccented syllable-tokens are word-final, whereas their accented counterparts are all word-initial. Besides, all unaccented target syllables belong to the category described in (2) above.

The aims of the Test were as follows:

(i) To investigate the durational relation of accented syllables to their unaccented counterparts where everything else remains the same (i.e. syntagmatic and paradigmatic structure and syllable-position) as far as applicable.

(ii) To investigate the potential difference in that relation as an effect of the difference in the category of unaccented syllables as is assumed to exist between those in the First Set and those in the Second.

(iii) To determine whether accent-based durational variations could still exist, perhaps slightly reduced, when the syllable-position factor is not the same for the target syllables to be durationally compared as in the Third Set.

In designing the Test, the following hypotheses were envisaged:

- I. That accented syllables would be on average longer than unaccented syllables in both the First and the Second Sets.
- II. That the potential margin of difference would be greater in the First Set as compared to that in the Second.
- III. That the potential margin of difference would be reduced in the Third Set where the target unaccented syllables are word-final whereas their accented counterparts are word-initial.

It should be noted, before analysing the results of the Test, that the vocalic nuclei are phonemically the same in the pairs of syllable-tokens compared in the Second and Third Sets. The same could not have been achieved in all pairs in the First Set (see, for instance, INTERDEPEND /ɪntə'dɪpend/ vs MENTALITY /mentə'lɪtɪ/).

The results of the Test were as follows:

1. Accented syllables are on average longer than those syllables classified as unaccented in the EPD. This result is derived from the cases of comparison in the First and Second Sets (see Tables Di and Dii) and it supports hypothesis I above.
2. That, in support of hypothesis II above, accented syllables are more consistently and more markedly longer than their unaccented counterparts in the First rather than the Second Set. In the First Set, they average a margin of difference that is 77 msec; in the Second, this margin drops to 49 msec. In the First Set, all accented syllables are longer than their unaccented counterparts; in

the Second, adverse cases of unaccented syllables being longer than their accented counterparts form approximately 10% of cases of comparison (3 out of 28 cases). The reduced magnitude of the margin of difference in favour of accented syllables together with the inconsistency of accented syllables in maintaining a margin of difference over unaccented syllables in the Second Set suggests that the unaccented syllables investigated in the First and Second Sets belong to two accentually different groups. We ascribe this to a possible lack of consistency in the EPD marking of syllables with secondary accents. That is, syllables of the sort of unaccented ones investigated in the Second Set should have been classified as receiving secondary accents. This is further enforced when we compare this result with that of Test C above. Accented syllables average a 40 msec margin of difference over syllables with secondary accent in that Test. That is, it is only 9 msec below the average margin of difference in favour of the accented syllables over their unaccented counterparts in the Second Set. Such a margin is obviously not significant.

3. Comparisons based on the Third Set do not just support hypothesis III above that the margin of difference in favour of accented syllables might be reduced where their unaccented counterparts are not, likewise, word-initial, but word-final. Whereas the margin of difference in favour of the accented syllables is only 49 msec in the Second Set, it is 117 msec in the Third Set, paradoxically, in favour of the unaccented syllables over their accented counterparts. If hypothesis III were to stand as fully as it was formulated, the margin of difference would still be in favour of the accented syllables but it would be reduced. The hypothesis

does in fact stand in an extreme way as the durational advantage is reversed in favour of unaccented syllables. This suggests that native speakers of English, or at least our informants, maintain accent-based durational variations in their speech only in so far as all factors of syntagmatic and paradigmatic structure and syllable-position within the words are uniform in the target syllables.

Word	Word	S1	S2	S3	S4
INTERDEPEND	PENTAMETER	< 57	< 76	< 74	< 47
CATASTROPHIC	PENTAMETER	< 83	<111	< 82	< 79
PHOTOGRAPH	PENTAMETER	< 77	<110	< 80	< 77
INTERDEPEND	MENTALITY	< 86	<107	< 60	< 57
CATASTROPHIC	MENTALITY	<112	<142	< 68	< 89
PHOTOGRAPH	MENTALITY	<106	<141	< 68	< 89
COCA COLA	CALCUTTA	< 47	< 44	< 49	< 60
PICCADILLY	CALCUTTA	< 71	< 39	<47	< 58

TABLE Di: Margins of durational difference in msec between unaccented syllables (according to the EPD clasification and to our proposed one as well) and their accented counterparts which are of identical syllable-positions

Words	S1	S2	S3	S4
<u>CAMPBELL</u> - <u>CAMBODIA</u>	> 8	> 51	> 51	> 54
<u>CALCIUM</u> - <u>CALCUTTA</u>	> 38	> 14	> 72	> 63
<u>MENTAL</u> - <u>MENTALITY</u>	>101	> 10	> 86	> 60
<u>CAPTAIN</u> - <u>CAPSIZE</u>	> 53	> 44	> 42	> 35
<u>SARCASM</u> - <u>SARCASTIC</u>	> 70	> 45	> 55	< <u>17</u>
<u>FULLNESS</u> - <u>FULFIL</u>	< <u>64</u>	> 5	> 1	< <u>8</u>
<u>CONDUCT</u> - <u>PRODUCT</u>	> 69	> 52	> 71	> 81

TABLE Dii: Margins of durational differences between unaccented syllables (according to the EPD classification only) and their accented counterparts which are of identical syllable-positions (values underlined are those adverse cases where the unaccented syllables are longer than their accented counterparts).

Words	S1	S2	S3	S4
<u>BOY</u> HOOD - COW- <u>BOY</u>	<159	< 76	<165	<101
<u>RATIONAL</u> - NETTLER <u>RASH</u>	<127	<133	<184	<117
<u>MEAL</u> TIME - PIECE <u>MEAL</u>	< 58	<106	<110	< 89
<u>WATCHFUL</u> - STOP- <u>WATCH</u>	<117	< 93	< 83	< 55
<u>SCHOOL</u> -BOY - DAY- <u>SCHOOL</u>	<136	< 51	< 50	> <u>1</u>
<u>HOUSE</u> HOLD - POWER <u>HOUSE</u>	<172	<121	<201	<273
<u>FAIRLY</u> - THOROUGH <u>FARE</u>	<152	< 38	< 86	<107

TABLE Diii: Margins of durational differences between unaccented syllables and their accented counterparts which are of different syllable-positions (the value underlined represents an adverse case of comparison where the unaccented syllable is shorter than its accented counterpart).

Test E

Unaccented Syllables in Pre- and Post-tonic Positions

In designing this Test, two Sets of word-pairs were selected from the EPD. In the First Set, the target syllables, identical syntagmatically and paradigmatically, occurred in word-initial pre-tonic positions in one word of the pair, and in word-final post-tonic positions in the other. In the Second Set, the target syllables, identical syntagmatically and paradigmatically as well, occurred in pre-tonic positions in one word of the pair and in post-tonic word-medial positions in the other. All target syllables in the Test appear as unaccented syllables in the EPD (our proposed classification as in Test I, K and L is not implemented in this Test).

The aim of the Test was to investigate the effect of syllable-position on the duration of unaccented syllables. The phrase "syllable-position" is used here to cover two interdependent factors:

- (1) the position of a given syllable with regard to the syllable receiving the tonic accent in the word (i.e. pre- or post-tonic)
- (2) the position of a given syllable from the point of view of the order of syllables constituting the word (i.e. word-initial, word-medial and word-final).

The results of the Test as derived from Table E (based on Appendix E) clearly indicate that the duration of unaccented syllables varies under the influence of those two factors:

- i. In the Second Set where the syllable-position is word-medial in each pair, it was found that syllable-position as the location of a

given syllable before or after the word tonic did not significantly affect the duration of syllables. The post-tonic syllables were on average longer than the pre-tonic unaccented syllable. The margin of difference, however, was not so marked as it averaged only 25 msec. In 12.5% of cases, the post-tonic syllable is even shorter than its pre-tonic counterpart. This percentage, though, was solely produced by informant S1, a fact for which there is no plausible interpretation.

ii. In the First Set where the above-mentioned two criteria of comparison between the two categories of target syllables were coupled together, the average difference in favour of the post-tonic and word-final position was more marked averaging 77 msec. There were no adverse cases of pre-tonic positions being longer.

Words	S1	S2	S3	S4
<hr/> THE FIRST SET <hr/>				
<u>FULFIL</u> - <u>HARMFUL</u>	< 75	< 40	< 30	< 18
<u>UPMOST</u> - <u>GET-UP</u>	< 47	< 60	< 45	< 55
<u>WHEREBY</u> - <u>UNDERWEAR</u>	<141	< 56	< 40	< 44
<u>COMMUNICATION</u> - <u>MINI</u>	<118	<153	<200	<123
<hr/> THE SECOND SET <hr/>				
<u>MILITARIZATION</u> - <u>MILITANT</u>	> <u>1</u>	< 25	< 15	< 14
<u>SPECIFICATION</u> - <u>SPECIFY</u>	< 36	< 11	< 51	< 2
<u>REPREHEND</u> - <u>CORRIDOR</u>	> <u>32</u>	< 54	< 32	< 4
<u>COMMUNICATION</u> - <u>UNIVERSE</u>	< 28	< 47	< 5	< 32

TABLE E: Margins of durational differences in msec of post-tonic syllables compared to their pre-tonic counterparts. (Values underlined are those where post-tonic syllables are shorter.)

Test F

Compounding

In designing this Test, eight compound words were included. (See below for a definition of "compound words"). They were randomly distributed throughout the lists to be recorded by informants. Included also were eight simple (i.e. non-compound) words, each of which was actually an element of a compound word included (e.g. MOUTH-ORGAN vs ORGAN). The random distribution was meant to avoid any unwanted contrast in the uttering of such pairs.

It should be spelt out at this point when a word was regarded as a compound. A compound word, in this context, is one that should satisfy three conditions:

- i. It is commutable; that is to say it can occur in various contexts with its component elements in the same order.
- ii. Each of its component elements can occur independently as a word.
- iii. One of the component elements is occasionally shown in pronouncing dictionaries (e.g. the EPD) with an accentual pattern different from that it appears with as an independent word.

e.g. EASTER /^ˈi:stə/

EASTERDAY /₁i:stə^ˈdeɪ/

The aim of the Test is to find out whether there are any durational changes that correlate with the accentual changes that an element in a compound is lexicographically presumed to undergo. In other words, if the #RU# syllable in the words RUNNER and RUNNER-UP is shown in the EPD with a primary accent and a secondary accent respectively, can there be any durational changes that account for

or reflect the accentual difference between the two tokens of the syllable?

All the simple words chosen were disyllabic words in order to help in comparing accented and unaccented syllables. It was hypothesized that in compounds where the target syllable of the target element receives a secondary accent such a syllable would be more likely to be shorter compared to the unaccented syllable than would be the target syllable with a primary accent.

The results, however, show that in most cases the unaccented syllable is longer than the accented syllable whether the latter receives a primary accent or a secondary accent (75% in simple words and 66.6% in compound words). Two Types of compounds need to be distinguished:

i. The First Type: Compounds with the target element occurring first.

ii. The Second Type: Those with the target element occurring second.

In the former, the target syllable receives a primary accent, in the latter a secondary accent. Whereas in the First Type of compounds, in 87% of the cases of comparison, the unaccented syllable is found to be longer than the one with the primary accent, only in 43% of the cases with regard to the Second Type of compounds, is the unaccented syllable found to be longer than the one with the secondary accent. Paradoxically, this does not seem to lend support to the hypothesis set forth above that syllables with primary accents would be more likely to average greater margins of durational difference than their unaccented counterparts in the same disyllabic element of a compound, than would be a syllable receiving a secondary accent. The result, though, should not be interpreted

Compound word	S1	S2	S3	S4	Simple Word	S1	S2	S3	S4
<hr/>									
The Second Type									
BLOOD-PRESSURE	< 17	> <u>27</u>	< 50	< 24	PRESSURE*	<169	< 74	<131	< 84
<hr/>									
MOUTH-ORGAN	<120	< 16	< 68	<120	ORGAN	<163	< 81	<134	< 90
<hr/>									
LETTER-BALANCE	<277	<173	< 57	<228	BALANCE*	<358	<281	<292	<283
<hr/>									
PEA-SHOOTER	< 50	> <u>52</u>	< 35	< 13	SHOOTER	< 25	> <u>12</u>	> <u>78</u>	< 58
<hr/>									

The First Type

PENNY-ROYAL*	< 43	> <u>5</u>	< 33	< 90	PENNY*	<138	<108	< 92	< 58
<hr/>									
EASTER-DAY	> <u>74</u>	< 1	> <u>9</u>	> <u>21</u>	EASTER	< 17	> <u>24</u>	< 21	< 36
<hr/>									
RUNNER-UP	> <u>56</u>	> <u>56</u>	< 7	> <u>3</u>	RUNNER	< 21	> <u>18</u>	< 8	< 21
<hr/>									
COCA-COLA*	< 27	> <u>8</u>	< 11	> <u>13</u>	COCA*	<105	< 72	<149	< 68
<hr/>									

Table Fi: Margins of durational difference between the second (unaccented) syllables of disyllabic simple words and of disyllabic elements of compounds on the one hand and their first syllables (with primary accent in simple words and secondary accent in the target element of compounds) on the other hand. N.B. Underlined values are those where the second syllables are shorter than the first ones. Initial syllables in words marked with * do not include the duration of the closure phase of a plosive.

Words	S1	S2	S3	S4
<u>ORGAN</u> : MOUTH- <u>ORGAN</u>	< 30	> <u>26</u>	> <u>3</u>	< 26
<u>SHOOTER</u> : PEA- <u>SHOOTER</u>	< 24	> <u>24</u>	< 42	< 2
<u>EASTER</u> : <u>EASTER</u> -DAY	< 13	< 69	< 50	< 15
<u>RUNNER</u> : <u>RUNNER</u> -UP	< 92	< 35	< 17	< 41

TABLE Fii: Margins of durational difference between syllables with primary accent in simple words and their counterparts with secondary accent in compound words. (values underlined are those where syllables with primary accent are shorter.)

as invalidating the hypothesis just referred to, since it is not only the effect of the variation from primary to secondary accent that is under examination. Interfering with it is the syllable-position factor: the unaccented syllable in the Second Type of compounds is not word-final as is the case in the First Type. Therefore, it is more likely to be longer in the First Type than in the Second one. For further discussion of word-final lengthening, see Test K below.

This explanation is further supported by the fact that the margins of durational differences in favour of unaccented syllables average 89 msec in the First Type (where that syllable is word-final), whereas these differences average only 31 msec in the Second Type (where that syllable is not word-final). The averages and percentages referred to so far are based on Table Fi above.

In Table Fii above, the durations of syllables with primary accents in simple words are compared with those of their

counterparts with secondary accent in compound words. In most cases, syllables with primary accent in simple words are found to be longer than their counterparts with secondary accent in compound words. In the first 8 cases of comparison where the syllable-positions of the target syllables compared are not the same, the average margin of difference is only 25 msec in favour of syllables with primary accent. Out of these 8 cases, there are 3 adverse cases of syllables with secondary accents being longer than their counterparts with primary ones. In the other 8 cases of comparison where the syllable-positions of the target syllables are identical, the average margin in favour of syllables with primary accent rises to 41 msec.

These results lend some support to the underlying hypothesis of the Test that there could be durational reflections of the primary accent/secondary accent dichotomy. That is to say, everything being the same, a syllable with a primary accent is bound to be longer than a syllable with a secondary accent in a compound word.

The fact that syllables with secondary accent in compounds are found to be shorter than their counterparts with primary accent in simple words is an indication that native speakers of English tend to be consistent in keeping a distinct margin of durational difference between syllables of identical paradigmatic and syntagmatic structure and position. This is supported by the fact that the average margin of durational difference in the last 8 cases of comparison is just within the JND. Thus, there is in the light of the limited data of this Test, some evidence that the accentual change presumed lexicographically to be undergone by the first syllable of a word like RUNNER when this word becomes an element of

a compound one like RUNNER-UP is manifested by durational variations. That is to say, compounding is at least partly achieved by accent-based durational variations.

Test G

Consistency of Secondary Accent

Marking in the EPD

In designing this Test a number of word-pairs have been selected from the EPD. The target syllables in such words are shown in the EPD with a secondary accent in one word of each pair and without (i.e. unaccented) in the other (e.g. RUMPTITUM vs RUMBUSTIOUS). Target syllables in each pair have the same syntagmatic and paradigmatic structure. Syllable-position in the word (initial, medial or final) is not taken into account in the selection of word pairs so that the target syllables receiving secondary accent are all word-initial. Some unaccented target syllables are word-initial (e.g. RUMBUSTIOUS), some are word-medial (e.g. OUTSIZES) some are word-final (e.g. LIFE-RENT). The word "SIZEABILITY" which is included in this Test does not appear in the EPD. It is inferred from derivationally similar words (e.g. CAPABILITY /₁keɪpəˈbɪlɪtɪ/) that if it were to appear in the EPD, its accentual pattern would be /₁saɪzəˈbɪlɪtɪ/.

The aim of the Test is to establish how consistent is the secondary accent marking in the EPD on the basis of durational relations of syllables. As the target syllables chosen fall into two categories (one with secondary accent, the other unaccented), the former category is expected to be longer than the latter if syllable-duration were to be a parameter that distinguishes these two types of accent.

The hypothesis underlying this Test is that the EPD is far from consistent in the marking of secondary accent, a fact that has

already been pointed out by Arnold (1956/1957:231). Arnold refers to the fact that a syllable like #VER# in CONVERSELY /^hkɒn vɜ:slɪ/ is shown as unaccented in the EPD, whereas the same syllable in, say, VERSIFICATION is shown with a secondary accent despite the fact that there is no discernible difference in terms of perceptual prominence. The same argument is true of compound words where an element in the compound is shown in the EPD with a secondary accent if it is pre-tonic, and is shown with no accent if it is post-tonic (e.g. /₁rent-^hfri:/ vs /^hlaɪf-rent/). Another case where the EPD sometimes abstains from assigning the secondary accent is where there is only one syllable preceding the primary accent (e.g. MILTONIC /mɪl^hˈtɒnɪk/ vs MILLIONAIRESS /₁ˈmɪljə^hˈneərɪs/).

As far as duration alone is concerned the results of the Test support the above-mentioned hypothesis with regard to the assumed inconsistency of the EPD in marking the secondary accent (see Tests I and K for further discussion of this inconsistency, and the latter for a list of typical examples). Table Gi shows the margins of durational differences between the target syllables in each word-pair where these words formed one-word utterances. Table Gii shows the margins of durational differences between target syllables which were embedded in sentences. In one-word utterances, in 58% of cases of comparison (excluding cases with no identical syllable-position) the unaccented syllable is found to be shorter than its counterpart. Only in one out of twelve cases, this difference slightly exceeds the JND. The average difference in favour of syllables with the secondary accent is only 16 msec, and coincidentally the average difference in favour of unaccented syllables, where they are longer than their counterparts with secondary accent, is also 16 msec.

These results indicate that there is no significant durational advantage for syllables with secondary accent over their unaccented counterparts.

In cases where the syllable-position is not the same for the two tokens of the target syllable, the unaccented syllables (all occurring in post-tonic positions) are all longer than their counterparts with secondary accents (all occurring in pre-tonic positions). One would expect them to be shorter if the accent-based durational variations were to override those based on syllable-position. These facts, however, supportive as they are of the underlying hypothesis of the Test cannot be interpreted at their face value as the accent-based durational variations are coupled with those based on the syllable-position factor and the former do not override the latter.

In longer utterances, the syllable-position factor has been kept constant in all pairs of syllable tokens compared. 50% of unaccented syllables are found to be longer than their counterparts. Moreover, the average margin of difference for unaccented syllables being longer than those with secondary accent and vice versa is, again, coincidentally the same (i.e. 27 msec). The only difference is that there are 5 cases where the margin of difference in favour of syllables with secondary accent is over the JND while there are only 2 similar cases for unaccented syllables. The rest of the cases of comparison (i.e. 70%) are below the JND.

Thus, there is nothing in the results of this Test that can be interpreted as indicating a reasonable tendency for syllables with secondary accents in the EPD to be of significantly consistently greater lengths than their unaccented counterparts. This is true

both in terms of the average margin of difference for syllables with secondary accent being longer than unaccented syllables and vice versa, and of the percentage of cases of comparison in which the former or the latter type of syllable are longer than the others.

However, as the unaccented syllables used in this Test are only of specific types, as indicated above, the argument about the lack of consistency in the EPD marking of secondary accent should be restricted to those types only. Besides, the present study uses duration as its sole criterion but does not assume that it is the only one. Further studies on the same lines followed here, namely keeping the syntagmatic and paradigmatic structure of target syllables constant, are required before any adequate generalizations can be reached.

Words	S1	S2	S3	S4
<u>RUMPTITUM</u> - <u>RUMBUSTIOUS</u>	< <u>38</u>	> 3	> 49	> 8
<u>PENTECOSTAL</u> - <u>PENTAMETER</u>	< <u>24</u>	> 7	> 23	> 5
<u>MILLIONAIRESS</u> - <u>MILTONIC</u>	< <u>12</u>	> 2	> 26	> 5
<u>SIZEABILITY</u> - <u>OUTSIZES</u>	< <u>58</u>	< <u>64</u>	< <u>42</u>	< <u>63</u>
<u>RENT-FREE</u> - <u>LIFE-RENT</u>	< <u>22</u>	<129	< <u>81</u>	< <u>64</u>
<u>MATRIMONIAL</u> - <u>DOOR-MAT</u>	< <u>79</u>	<101	<147	< <u>41</u>

TABLE Gi: Margins of durational difference in msec between syllables with secondary accent and their counterparts with secondary-like accent (unaccented in the EPD) in one-word utterances. (Values underlined are those where syllables with secondary-like accent are longer.)

Words	S1	S2	S3	S4
<u>LOCHNAGAR</u> - <u>LOCHLEVEN</u>	<10	< 8	>21	> 7
<u>NEW-FASHIONED</u> - <u>NEWTONIAN</u>	<83	>45	>39	>80
<u>MILLIONAIRESS</u> - <u>MILTONIC</u>	>14	>41	>40	<38
<u>RUMPTITUM</u> - <u>RUMBUSTIOUS</u>	< 3	<19	>21	> 2

TABLE Gii: Margins of durational difference in msec between syllables with secondary accent and their counterparts with secondary-like accent (unaccented in the EPD) in long utterances. (Underlining as in Table Gi.)

Conclusions of Chapter II

The conclusions of this Chapter can be summed up on a Test-by-Test basis as follows:

Test A. In this Test, the effect of the position in the word of the syllable with the tonic accent on its duration was investigated.

Two Sets of word-pairs with target syllables of identical syntagmatic and paradigmatic structures were selected from the EPD. In the one Set, the target syllables had identical syllable-positions. In the other, they did not have identical syllable-positions; in fact they were always relatively "earlier" in terms of order from left to right in one group than they were in the other. It is noteworthy that in this latter Set, no word-final syllables were included as target ones. Only an inconsequential average margin of difference existed in the First Set as

hypothesized. A similar margin existed in the Second Set. This latter result replicates for English Nootboom's (1972: 64-67) results for Dutch. It indicates that word-medial accented syllables do not on average show considerable durational variations compared to their word-initial or earlier word-medial counterparts.

Test B. In this Test, we investigated the durational relations between the two syllables in given words that are both marked as receiving primary accents in the EPD (especially in the 13th edition). Investigated also were the durational relations between the vocalic nuclei of such syllables. In one-word utterances, the tonic syllables were in most cases longer than the non-tonic ones averaging 75 msec. In all cases where the non-tonic syllables were longer, they were of heavier syntagmatic structures. Vowel-duration showed some degree of correlation to syllable-duration variations but it was less consistent as there were cases where tonic vowel nuclei were shorter than their non-tonic counterparts despite the fact that their respective syllables were longer and vice versa. In longer utterances, the number of cases where the lexicographical non-tonic was longer than the tonic was comparatively greater than it was in one-word utterances. This was interpreted as lending support to the hypothesis that in utterances with contrastive contexts, the durational advantage of the lexicographical tonics can be assumed by the lexicographical non-tonic which in this case can be called "the contextual tonic".

Test C. In this Test, the durational relation between syllables with primary accent and those with primary unreduced (i.e.

secondary) accent was investigated. It was found that in 85% of cases of comparison, syllables with primary accent were longer than their counterparts with secondary accent averaging 40 msec (i.e. just within the JND).

Test D. In this Test, the durational relations between syllables with primary accent and those with EPD unaccented syllables were investigated. Two categories of unaccented syllables were distinguished: unaccented syllables regarded as rightly classified in the EPD and unaccented syllables that, according to our proposed classification, are receiving secondary-like accents. The former category represented material in the First Set, and the latter represented the material in the Second Set. All accented syllables in the First Set were found to be uniformly longer than their unaccented counterparts averaging 77 msec. In the Second Set there were a few adverse cases of unaccented syllables being longer than their accented counterparts. The margin of difference in favour of accented syllables dropped from 77 msec to 49 msec. Taking into account the fact that the margin of difference between accented syllables and their counterparts with secondary accent was only 40 msec (Test C), we suggested that the results of the Second Set indicated a possible lack of consistency in the EPD marking of syllables with secondary accent. Investigated in this Test also was the effect of syllable-position compared with the accent-based effect on syllable-duration. In the Third Set of this Test, target unaccented syllables were of the same category as those in the Second Set but they were all word-final while their accented counterparts were word-initial. In 27 out of 28 cases of

comparison, unaccented syllables were found to be longer than their accented counterparts averaging 117 msec. Thus, the final lengthening of EPD unaccented syllables did not only reduce the durational advantage of accented syllables but it overrode it. This is to say that accent-based lengthening is not always paramount to word-final lengthening as reported by Vaissière (1983)

.

Test E. In this Test, the effect of syllable-position on the duration of unaccented syllables was investigated. Two variables in this respect were manipulated: whether the position of the target syllable was pre- or post-tonic, and whether it was word-final or word-initial. Post-tonic syllables were found to be longer than their pre-tonic counterparts averaging only 25 msec, and there were a few adverse cases of comparison where the pre-tonic syllables were longer than their post-tonic counterparts. Where post-tonic syllables were themselves word-final ones, the average margin of difference rose to 77 msec, and there were no adverse cases of pre-tonic word-initial syllables being longer than their post-tonic word-final counterparts. Thus, syllable-position as the location of a given syllable before or after the word tonic did not affect syllable-duration considerably unless post-tonic syllables were themselves word-final ones.

Test F. Like Test C, this Test investigated the relation between primary and secondary accent. One specific category of syllables with secondary accent, though, was considered, namely syllables marked as such in compound words. Comparisons were made both between syllables with primary accent (in simple words) and

secondary accents (in compound words) and between the first and second syllables (unaccented) of disyllabic simple words and of syntagmatically and paradigmatically identical elements of compound words. Unaccented syllables were found to be in most cases longer than their counterparts whether they had primary accents or secondary accent. Two Types of compounds could be distinguished, though: those where the syllable with the secondary accent occurred in the first element and those where it occurred in the second element. In the Second Type, unaccented syllables being word-final were longer than their counterparts with secondary accents in 87% of cases averaging 89 msec. In the First Type, being non-word-final, they were longer in 43% of cases only, averaging as little a margin of difference as 31 msec. Whereas the greater margin of difference between unaccented syllables and syllables with primary accent in the Second Type (i.e. 93 msec) is understandable in the light of the preceding explanation, the considerably greater margin in the First Type (i.e. 222 msec) is not. Direct comparisons between syllables with secondary accent in compound words on the one hand and syllables with primary accent in simple words on the other revealed that the average margin of difference was just within the JND only in cases of comparison where syllable-position was identical. It dropped to 25 msec in other cases where it was not. These results showed that the accentual demotion undergone by given tokens of syllables from simple words to compound words was found to be manifested by durational variations.

Test G. This Test investigated the consistency of the secondary accent marking in the EPD. This was done by comparing a certain

category of EPD unaccented syllables with syllables of identical syntagmatic and paradigmatic structures and which were marked with secondary accents in the EPD. There was nothing in the results of this Test that could be interpreted as indicating a reasonable tendency for syllables with secondary accent in the EPD to be of significantly consistent greater lengths than their counterparts which we regarded as belonging to a category of syllables that were characterised by secondary-like prominence and would have been more properly classified if marked with secondary accents.

CHAPTER III

Word-Accent in the Long Utterance Domain

Introduction:

This Chapter covers a wider area of investigation than that of Chapter II. In Tests CU, DU, and EU, it investigates, as in Chapter II, the relationship between syllable-duration and the different types of accent a given syllable receives. Unlike Chapter II, though, it deals with this relationship in longer utterances (as distinct from one-word utterances). Those Tests are marked with U after C, D and E to distinguish them from their counterparts in Chapter II. In Tests H, I and J, the Chapter studies the effects of apposition, of changes in speech-rate and of extra-strong accent on this relationship. In Test K, the assumed dissociation of accent phenomena into sentence-accent and word-accent is considered through the comparison of syllable-duration in the tokens of given words in one-word utterances on the one hand and in longer utterances on the other. An attempt at establishing reliable average durations of syllables with different types of accent is carried out in Test L which is based on the analysis of a corpus of 50 sentences.

The facts stated in the introduction to Chapter II with regard to the methods, limitations, material, informants, recording procedures, equipment and syllabification and calculation conventions apply also to this Chapter.

The Word as a Phonetic Entity

In view of the focus on word-accent in connected speech, it is relevant at the outset of this Chapter to touch upon the phonetic

status of the word. The word is regarded as a unit of the structure of English. Simpson (1979:100) writes "It is usual to recognize the word, since it is a grammatical unit...". He expands on Bloomfield's (1933:178) definition of the word as "the minimum free form" and defines words as:

"...morphs or sequences of morphs that are characterized by potential external mobility within larger structures and by internal stability, which implies indivisibility by other morphs and the maintenance of the same sequence" (Simpson 1979:100).

Due to isolating phonetics from other linguistic disciplines, some investigators (e.g. Passy 1930 and Bloomfield 1930 - both cited in Jones 1931) did not regard the word as a phonetic entity. In the words of Kruisinga (1943:1).

"The phoneticians of the nineteenth century considered it a great discovery that a word is not a phonetic unit: a sentence consists of syllables, syllables consist of one or more sounds, and these sounds are the result of combinations of more or less completely contemporaneous activities of the organs of speech".

The extreme view of not regarding the word as a phonetic entity would seem tenable on considering such sequences as AN AIM vs A NAME. Jones (1931) shows that in such pairs of potentially ambivalent sequences, there are always phonetic differences such as accentual distribution, existence versus lack of aspiration, voicedness versus complete or partial voicelessness. He therefore argues that the word is a phonetic entity in its own right. This does not discount the fact that acoustic ambiguity with regard to identical phonemic sequences does sometimes take place. Kramsky (1969:29-37) calls this phenomenon redundancy and ascribes it to the

fact that "a language does not exploit all the possible sound combinations in its words" (1969:37).

Browman (1978:96) refers to various pieces of evidence that the speech continuum "contains cues for chunking":

"Word-initial consonants are longer than word-medial or word-final consonants (in non-phrase-final position)... initial voiceless stops have a greater degree of aspiration, initial voiced stops have less intensity in the higher harmonics, laterals have different formant structures word-initially and word-finally... Word-final boundaries are marked by increased duration of the final syllable...they are marked also by decreased intensity on the final syllable".

In this same study of Browman's on the implications of speech errors for language processing, she (1978:71) finds that when word boundaries are not correctly perceived, many target segments in the signal are likewise not correctly perceived with deletions or insertions of segments clustering around the misperceived boundaries. These findings together with the pieces of acoustic evidence quoted above confirm that the word is as much a unit of speech perception as well as production.

In his article "The word as a processing unit in speech perception", Cohen (1980) refers to other pieces of evidence in this respect. He cites Foss and Swinny (1973) as having found that in monitoring tasks, informants were faster in responding to words than to phonemes or syllables. Ganong (1978) is similarly cited as having found that informants react faster in phoneme monitoring tasks to phonemes occurring in existing words than to ones in nonsense ones.

In the final analysis, to reject the fact that the word is a

phonetic entity is an extreme view since it sacrifices the general rule for the sake of a few potentially ambivalent phonemic sequences. It is far-fetched to assume that the listener can process the incoming acoustic signal without resorting to his/her syntactic, semantic and lexical knowledge of the language spoken. In the words of Cohen:

It is this great familiarity with the lexical stock of our language that enables us to recognize words in the very many and variegated guises into which their acoustic shapes occur due to the influences of speaker characteristics, rate of speech, emotion, register, place within the utterance, high or low information content, prosodic patterns including various forms of pitch, temporal organization and intensity... Taking the vantage point of the word form it becomes clear that studies devoted to the relation between the shape of the acoustic signal and phoneme like segments was [sic] indeed a wild goose chase " (Cohen 1980:265).

Test CU

Primary and Secondary Accents

Like Test C in Chapter II, this Test deals with the durational relation between syllables with primary accent on the one hand and those with non-primary unreduced (secondary) accent on the other. The material for the Test consists of words in longer utterances as distinct from one-word utterances (as in Test C). Two Sets of word-pairs were chosen from the EPD and embedded in sentences. In the First Set, the target syllables are an accented syllable in one word of the pair, and a syllable with an EPD-marked secondary accent in the other. In the Second Set, the target syllables are, again, an accented syllable in one word of the pair and a syllable with a secondary-like accent in the other. Table CU shows the margins of

durational difference for the First and the Second Sets. This Table is derived from Appendix Cu.

The aim of the Test was to find out to what extent the lexicographical classification of accents into primary and secondary would be reflected by duration while on the other hand considering whether the lack of the secondary accent mark for a given type of syllable in the EPD is justifiable.

The results of the Test confirm those of Test C. Accented syllables are mostly longer than their counterparts with EPD-marked secondary accent. In the First Set, in 16 out of 17 cases, syllables with primary tonic accents are longer than their counterparts with secondary accent averaging 57 msec. Besides, in 28 out of 35 cases, syllables with primary non-tonic accent are longer than their counterparts with secondary accent averaging 33 msec. The remaining 7 cases whose syllables with secondary accent are longer than or equal to their accented counterparts average only 20 msec. On the whole, accented syllables, where they are longer, average 42 msec (i.e. just within the JND).

In the Second Set, all 16 syllables with primary tonic accent are longer than their counterparts averaging 45 msec. In 14 out of 20 cases, syllables with primary non-tonic accents are longer than their counterparts averaging 35 msec. The remaining 6 cases, where the unaccented syllables (according to the EPD) are longer than or equal to their accented counterparts, average 7 msec only. On the whole, accented syllables, where they are longer, average 40 msec, (i.e. just within the JND).

Results of the First Set indicate that accented syllables in long utterances (as distinct from one-word utterances) are mostly

longer than syllables with secondary accent. Results of the Second Set are comparable to those of the First Set as the average margin of difference in the First Set drops only from 42 msec to 40 msec in the Second Set. This comparability, again, suggests the inconsistency in the EPD marking of secondary accent.

The First Set

Syllables with secondary accent	Syllables with primary accent	S1	S2	S3	S4
<u>SPECIFICATIONS</u>	<u>SPECIFY</u>	* <11	x <28	x <28	* <15
<u>FUNDAMENTALS</u>	<u>FUNDAMENT</u>	x >89	x 0	x <42	x <4
<u>ARTIFICIAL</u>	<u>ARTIST</u>	x >16	x >3	* >6	x >1
<u>PERSEVERED</u>	<u>PERSON</u>	x <1	x <27	x <17	x <35
<u>CATASTROPHIC</u>	<u>CATEGORIES</u>	x <14	x <89	x <7	x <37
<u>UNDERLYING</u>	<u>UNDERDOGS</u>	* <92	* <18	* <18	* <6
<u>IMPERCEPTIBILITY</u>	<u>SEPARATELY</u>	* <101	* <43	* <105	* <101
<u>OVERNIGHT</u>	<u>OVERSEAS</u>	x <52	x <43	x <5	x <15
<u>AUTOMATIC</u>	<u>AUGUR</u>	x <56	x <26	x <75	x <34
<u>TRANSOCEANIC</u>	<u>OVERSEAS</u>	x <39	x <28	x >10	x >24
<u>ECONOMICALLY</u>	<u>ERRAND</u>	x <45	* <73	* <39	x <28
<u>MISUNDERSTAND</u>	<u>MISTER</u>	x <34	x <39	x <58	x <45
<u>SPECIFICATIONS</u>	<u>SPELLING</u>	* <93	* <38	* <99	* <69

Table CU: (continued below).

The Second Set

Syllables with secondary-like accent	Syllables with primary accent	S1	S2	S3	S4
<u>PENTAMETER</u>	<u>PENCIL</u>	x <33	x <18	x <26	x 0
<u>FILTRATION</u>	<u>FILTER</u>	x <74	x <19	x <67	x <26
<u>PIECEMEAL</u>	<u>MEALTIME</u>	* <45	* <14	* >15	* <98
<u>MENTALITY</u>	<u>MENTAL</u>	x >4	x >23	x <46	x >10
<u>SARCASTIC</u>	<u>SARCASM</u>	* <39	* >9	* <81	* <46
<u>MENTALITY</u>	<u>DIMENSIONS</u>	* <17	* <45	* <85	* <49
<u>PROCESS</u>	<u>ASSESSMENT</u>	x <50	x <28	* <54	* <67
<u>UPHEAVALS</u>	<u>UPRIGHT</u>	x 0	x <41	* <15	x <25
<u>MENTALITY</u>	<u>MENTIONED</u>	x <15	x <22	* <48	x >9

Table CU: Margins of durational difference in msecs between syllables with primary accent and their counterparts with secondary accent (First Set) or secondary-like accents (Second Set).

N.B. The values underlined are those where accented syllables are shorter than their counterparts. * margins involving accented syllables with primary tonic accent, x margins involving accented syllables with primary non-tonic accent.

Accented and Unaccented Syllables

The comparison that is being made in this Test is, as in Test D in Chapter II, between accented syllables on the one hand and unaccented syllables on the other hand. The words constituting the target syllables were embedded in sentences. The syllables compared were identical syntagmatically and paradigmatically. Syllable-positions of the two tokens of given syllables were identical in 9 word-pairs (e.g. INTENDED vs INTAKE) and non-identical in the remaining 6 word-pairs (e.g. DISCRIMINATED vs ADMINISTRATIVE). We distinguished in this Test between accented syllables with primary tonic accents and those with primary non-tonic ones. This distinction was subjectively made by the present investigator and checked by a professional phonetician who is at the same time a native speaker of English (see Table DU where the margins of difference resulting from comparing unaccented syllables with those receiving primary tonic accents are marked by * and those resulting from comparing unaccented syllables with those receiving primary non-tonic accents are marked by x).

The results of this Test confirm the result of Test D above that accented syllables are mostly consistently and more markedly longer than their unaccented counterparts. In 95% of cases of comparison, accented syllables are longer than their unaccented counterparts. All 23 tokens with primary tonic accents are longer than their counterparts with a 64 msec average margin of difference. Out of the remaining 37 accented syllables, 34 tokens with primary non-tonic accents are longer than their counterparts averaging a 51 msec margin of difference. Only 3 accented syllables

Word	Word	S1	S2	S3	S4
DIFFICULTIES	ARTIFICIAL	x <61	x <11	x <31	x <3
REPUBLICANISM	RELIGIOUS	* <35	x <54	x <31	x <51
DISCRIMINATED	ADMINISTRATIVE	* <60	* <74	* <39	* <39
POLITICAL	COMPETITIONS	x <66	x <30	* <88	* <60
INTENDED	INTAKE	* <38	x <36	* <39	x <25
SPECIFY	CONSIDERED	x <49	x >31	x >32	x <34
VERSIFICATION	CONSIDERED	x <34	x <1	x <28	x <45
EMPIRICAL	RHYTHM	x <41	* <31	x <26	* <65
ARTIFICIAL	COMPETITIONS	x <42	x <79	* <83	x <48
CATASTROPHIC	MENTALITY	* <63	* <72	* <75	* <118
CONSIDERED	CONCEPT	x <81	x <101	x <60	x <96
CONCEALED	CONCEPT	x <47	x <101	x <23	x <154
AUTOMATIC	MILTONIC	x >15	x <77	x <45	x <59
MACHINEGUNS	AUTOMATIC	* <62	* <67	* <56	* <47
AUTOMATIC	PENTAMETER	x <73	* <124	* <90	* <67

Table DU: Margins of difference in msecs between syllables with primary tonic accent (*) or primary non-tonic accent (x) on the one hand and their unaccented counterparts on the other (derived from Appendix DU).

with primary non-tonic accent are shorter than their counterparts with an average margin of difference of 26 msec only.

Test EU

Unaccented Syllables

Like Test E in Chapter II, this Test deals with unaccented syllables, and unlike it, its material consists of unaccented syllables in word-tokens that occur in longer utterances. Two Sets of word-pairs are included. In the First Set, the target syllables, identical syntagmatically and paradigmatically, occur in word-initial pre-tonic positions in one word of the pair, and in word-final post-tonic positions in the other. In the Second Set, the target syllables, identical syntagmatically and paradigmatically as well, occur in word-medial pre-tonic positions in one word of the pair and in word-medial post-tonic positions in the other. We do not distinguish in this Test between unaccented syllables that we regard as receiving "secondary-like" accent and the remaining syllables classified as unaccented in the EPD.

The aim of the Test was, like Test E, to investigate the effect of syllable-position on the duration of unaccented syllables. The results of this Test confirm the results of Test E. In the Second Set, where the syllable-position is word-medial in each pair, it was found that syllable-position as the location of a given syllable before or after the word tonic did not affect the duration of syllables too much. The post-tonic syllables were longer than their pre-tonic counterparts in 16 cases averaging 27 msec. The pre-tonic syllables, on the other hand, were longer than their counterparts in 11 cases only averaging 15 msec. In the First Set, where the

Word	Word	S1	S2	S3	S4
<hr/>					
<u>THE FIRST SET</u>					
<u>FULFIL</u>	HARM <u>FUL</u>	>132	<22	<80	>107
<hr/>					
<u>UPHEAVAL</u>	GET <u>UP</u>	<9	<7	>37	<18
<hr/>					
<u>WHEREBY</u>	UNDER <u>WEAR</u>	<96	<66	<164	<74
<hr/>					
<u>THE SECOND SET</u>					
SPEC <u>IFICATIONS</u>	SPEC <u>IFY</u>	<17	<15	<30	>26
<hr/>					
VER <u>SIFICATION</u>	SPEC <u>IFY</u>	>15	<32	<60	<11
<hr/>					
INVEST <u>IGATION</u>	PRACT <u>ICAL</u>	>41	<21	>15	>17
<hr/>					
<u>OVERSEAS</u>	<u>OVERNIGHT</u>	>6	0	<10	<23
<hr/>					
FUND <u>AMENTALS</u>	FUND <u>AMENTS</u>	<7	<12	<55	<24
<hr/>					
MISUNDER <u>STAND</u>	UNDER <u>DOGS</u>	<37	<38	<8	>29
<hr/>					
<u>ARTIFICIAL</u>	POLIT <u>ICAL</u>	>24	<49	>5	>12
<hr/>					

Table EU: Margins of durational difference between EPD pre- and post-tonic unaccented syllables.

word-initial/word-final difference is coupled with the pre-tonic/post-tonic one, post-tonic syllables are longer than their counterparts in 9 cases averaging 59 msec.

The pre-tonic tokens are longer than their counterparts in 3 cases only, but they average 92 msec in these cases. This average seems unreliable since it is based on relatively a few cases. See Table EU for the margins of durational difference (derived from Appendix EU).

Test H

The Prominence of Appositional Phrases

In designing this Test, three sentences were constructed and randomly distributed in the lists to be recorded by the informants. Each of those sentences contained an appositional phrase¹, e.g.

THE CONFERENCE, THE ONE IN LONDON, IS BELIEVED TO HAVE COME
TO SOME SIGNIFICANT CONCLUSIONS.

The aim of the Test is to investigate the way appositional phrases are rendered prominent or distinct from within the sentences containing them. There was no intention in including this Test of stepping outside the area of investigation of the present thesis, namely the inter-relations between syllable-duration and syllable accent with respect to words. This type of phrase in particular is chosen as the material for the Test because we hoped through

1 The OED defines apposition as: "The placing of a word beside, or in syntactic parallelism with, another, spec. the addition of a substantive to another, or to a noun clause, as an attribute or complement...." (1933:410).

studying this particular type of prominence to achieve a better understanding of the nature of the relationship among the three factors of syllable-duration, word-accent and prominence.

The hypothesis underlying the Test was that average syllable-duration in appositional phrases might differ (by way of increase or decrease) from the corresponding average of the sentences constituting them. For such a difference to be effective in rendering the appositional phrases prominent, it would presumably be at least as much as the JND.

Comparison of averages was carried out in two ways:

- i Average syllable-duration (regardless of the type of accent a syllable receives) in appositional phrases was compared to the corresponding average in the rest of the sentences containing them. Results of this sort of comparison are shown in Figure Hi where columns represent the averages for individual informants as well as the general one.
- ii The durational average of accented syllables and that of unaccented syllables in appositional phrases were compared to their counterparts in the sentences containing them.

Results of this sort of comparison are shown in Figures Hii and Hiii for each individual informant. Appendix H shows the actual durations of syllables, whether or not they are part of an appositional phrase, and the type of accent each syllable receives. In polysyllabic words, the type of accent a given syllable receives is decided according to the marking of the EPD. Monosyllables are assigned the type of accent we judge to be suited to their relative prominence in the sentences. Due to the limited scope of the appositional phrases and that of the Test as whole, our proposed

classification of monosyllables and some syllables in polysyllabic words into secondary, secondary-like and unaccented syllables is abandoned here. Only one syllable in the sentences lexicographically receives a secondary accent, 22 are accented (6 of them in appositional phrases) and 40 unaccented (8 of them in appositional phrases).

Figure Hi shows that average syllable-durations are consistently greater in appositional phrases than in the sentences containing them. The margin of difference ranges from 5 msec in the case of S2 to 29 msec in the case of S1 averaging only 17 msec. These margins of difference, then, are not great enough to support the hypothesis made above with regard to the potential existence of significant margins of difference between syllable-duration averages in appositional phrases and the sentences containing them.

Figures Hii and Hiii respectively show that the duration of accented and unaccented syllables in appositional phrases are on average, in almost all the cases of comparison, greater than their counterparts in non-appositional phrases. The margin of durational difference with regard to accented syllables ranges from 6 msec in the case of S3 to 40 msec in the case of S4. The margin of difference with regard to unaccented syllables ranges from 5 msec in the case of S4 to 30 msec in the case of S1. In one single case of comparison, unaccented syllables in a non-appositional phrase are found to be greater on average than their counterparts in the appositional phrase (the difference being 16 msec).

To sum up the results of the Test so far, it is clear that, though the margins of difference in all items compared are consistently in favour of appositional phrases—a fact that offers

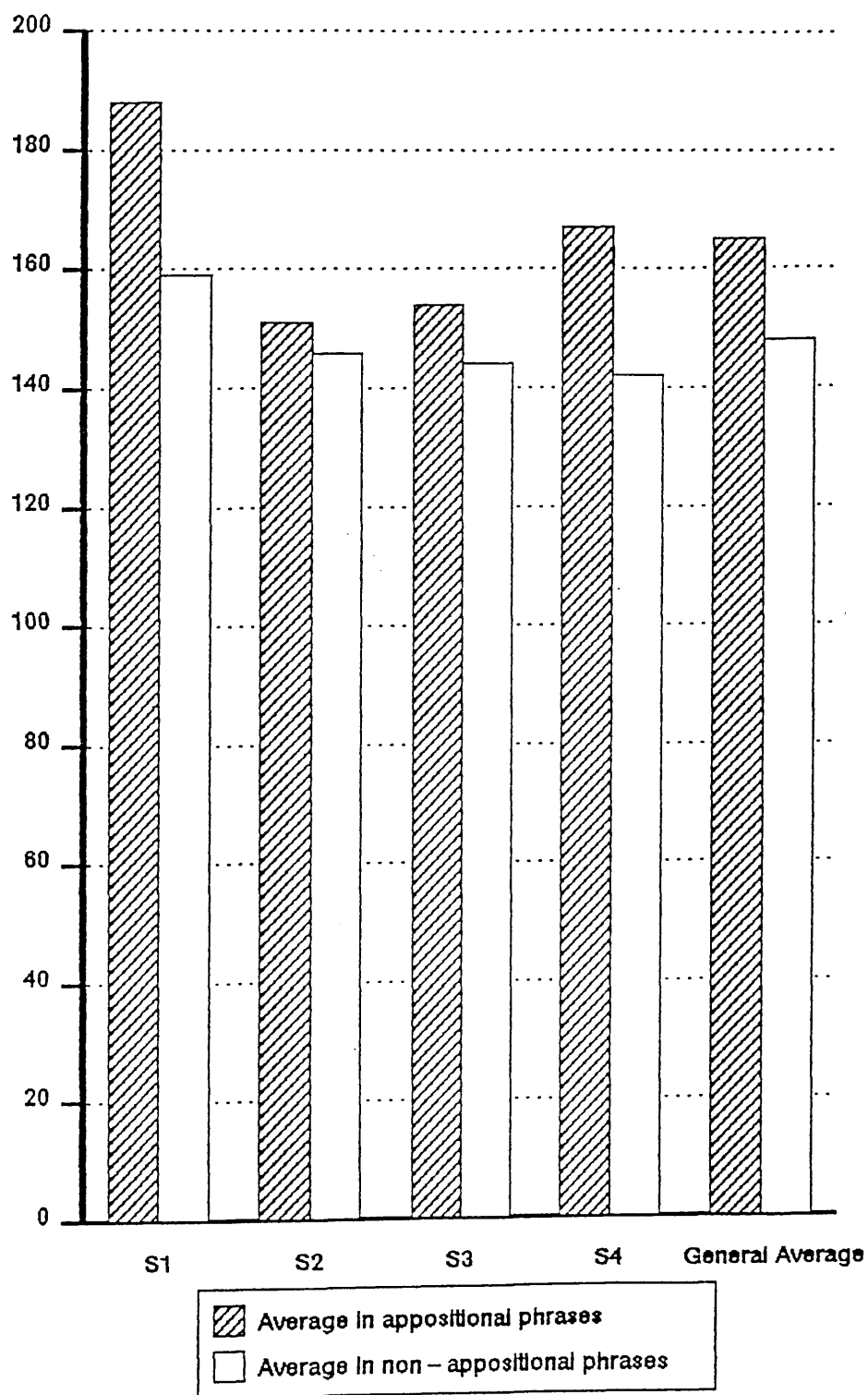


Figure Hi : Average syllable-duration in msec in appositional and non-appositional phrases.

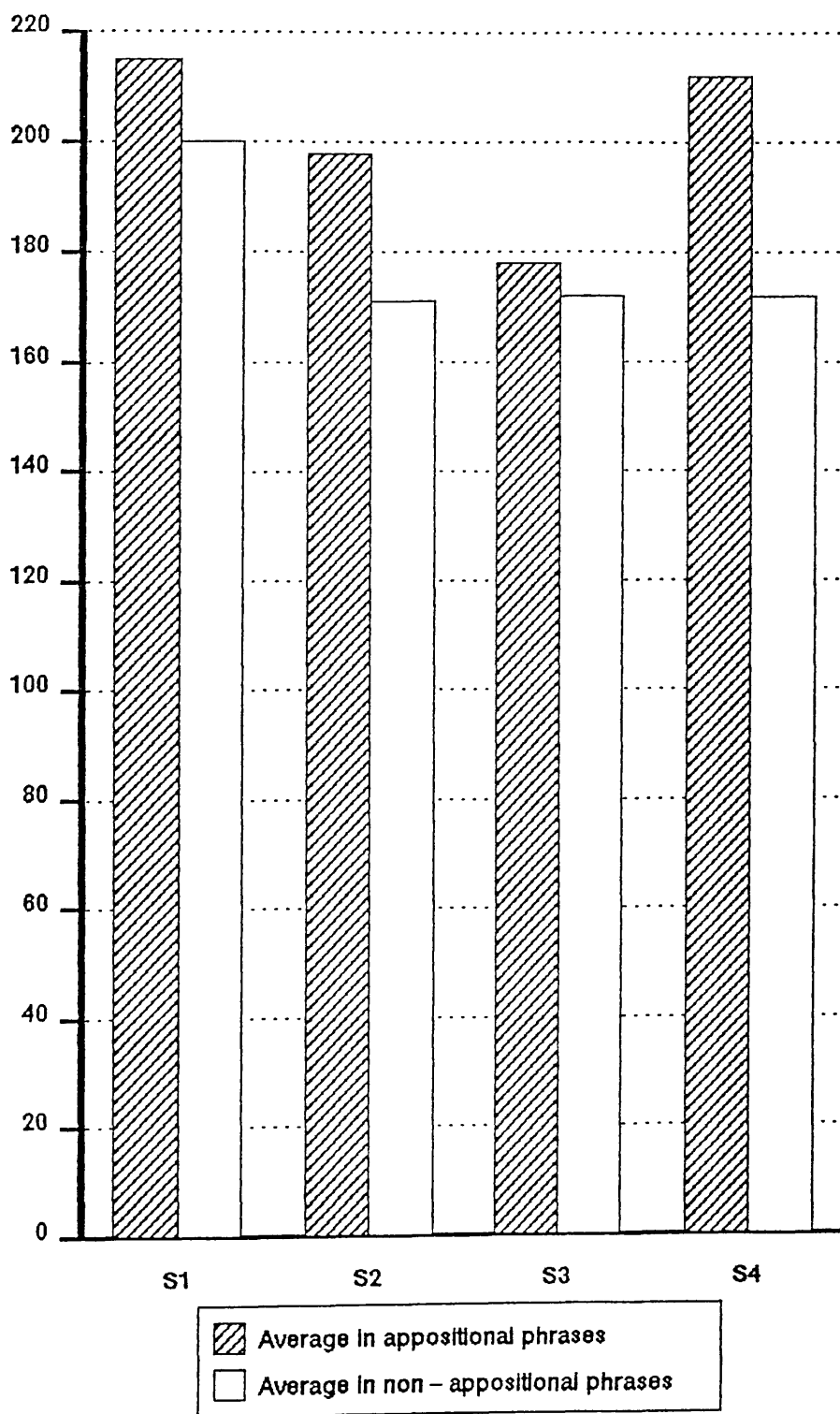


Figure Hii: Average syllable-duration in msec of accented syllables in appositional and non-appositional phrases.

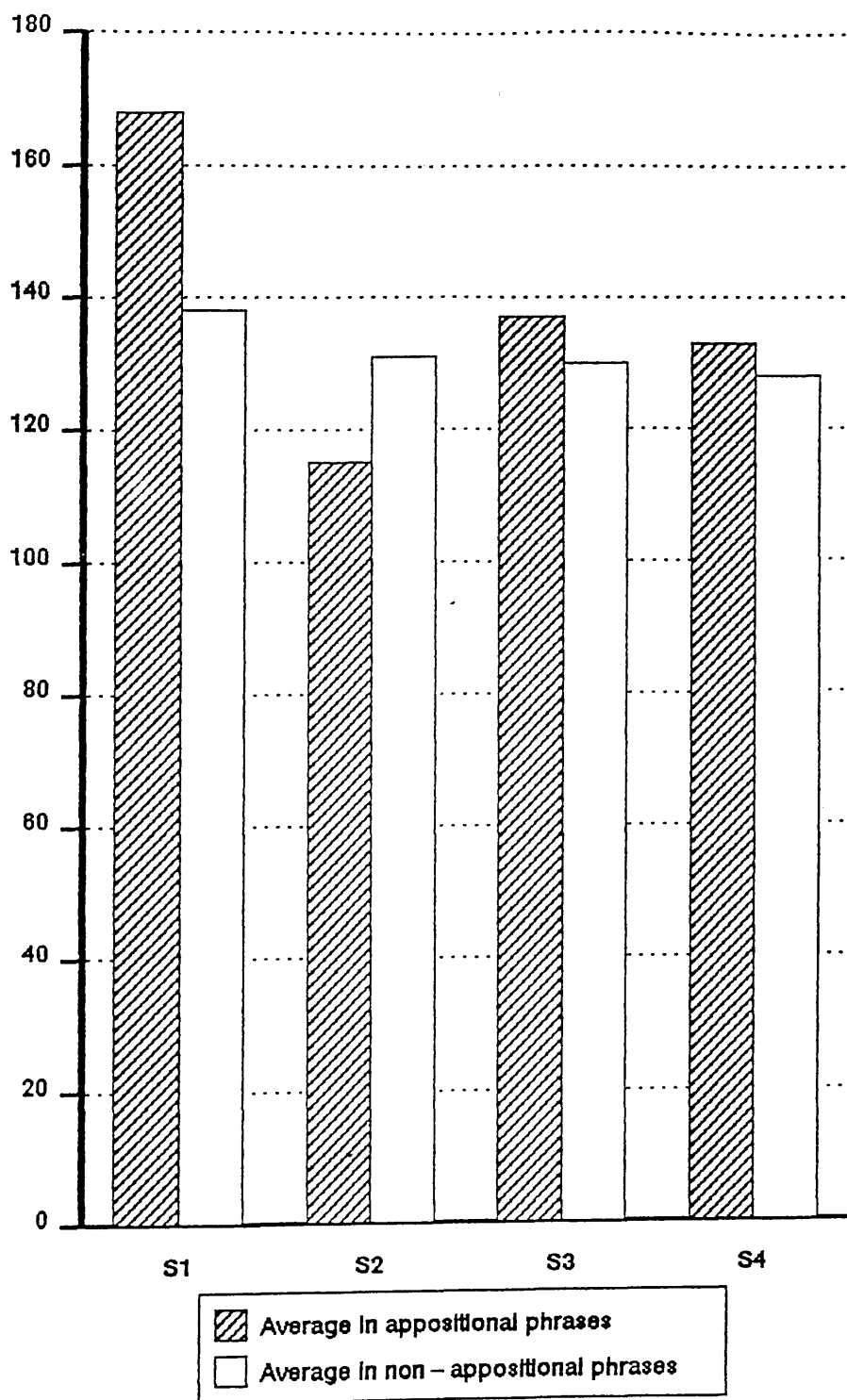


Figure Hiii: Average syllable-duration in msec of unaccented syllables in appositional and non-appositional phrases.

some indication to the validity of the hypothesis set forth above—the magnitudes of the margins of difference, with the exception of one single case, are well below the threshold of perception. Syllable—duration, then, cannot be regarded as the only factor that potentially renders appositional phrases prominent.

We alternatively investigate "pausing" as another potential factor in this respect. Table Hiv below shows the duration of the pre- and post-appositional phrase (A.P.) pauses in each of the three sentences of the Test.

SENTENCE	PAUSE	S1	S2	S3	S4
1ST	PRE-A.P.	-	322	-	-
"	POST-A.P.	31	380	391	307
2ND	PRE-A.P.	37	37	52	301
"	POST-A.P.	20	232	292	219
3RD	PRE-A.P.	-	690	290	206
"	POST-A.P.	232	391	562	172

Table Hiv: Duration of pre- and post-appositional phrase pauses.

It was hypothesized that if pausing were to be the only parameter that rendered appositional phrases prominent, there must be:

- (1) consistent perceptible pauses before and after each appositional phrase, and if so,
- (2) those pauses might be of tempo-related durations.

Table Hiv, though, shows that:

- (1) there is not always pausing at the boundaries of appositional phrases. At 4 out of 24 boundaries (all four being in pre-A.P. positions), there were no pauses at all. At four other boundaries (in pre- and post-A.P. positions) the pauses that occur are below the threshold of perception. Thus, in 33% of cases approximately, there are either imperceptible pauses or no pausing at all.
- (2) though all the cases where pausing does not exist are in pre-A.P. positions, imperceptible pausing does occur in pre- and post-A.P..
- (3) average pause duration, where pausing does occur, is 258 msec. That is to say, the average pause duration is greater than the average syllable-duration and greater even than the average duration of accented syllables. As pausing does not occur consistently to mark the boundaries of appositional phrases, the relation of pause-duration to the syllable-per-second rate was not investigated.

To conclude, though at 66% approximately of appositional phrase boundaries there were significant pauses, pausing could not be regarded as the only parameter that rendered that type of phrase prominent.

It was initially thought that pitch might be the one factor

that consistently marks appositional phrases. Besides, it was thought that this is achieved by a general change of pitch baseline level or by deviation from the pre- and post-A.P. contours. Figure Hv shows some intonation contour displays of some utterances of this Test where the boundaries of appositional phrases are marked by ||.

These contours show that appositional phrases are marked by deviations from the preceding and following contours. No significant changes of baseline levels are noted. Figure Hvi shows cases where appositional phrases are not marked by significant deviations from the preceding and following contours either. Thus, pitch can only be regarded as another factor that partially characterizes appositional phrases.

INTONATION -CONTOUR -DISPLAY

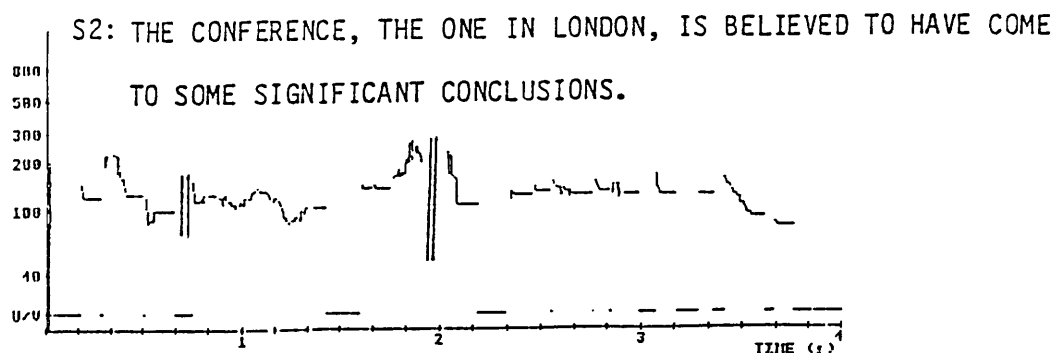
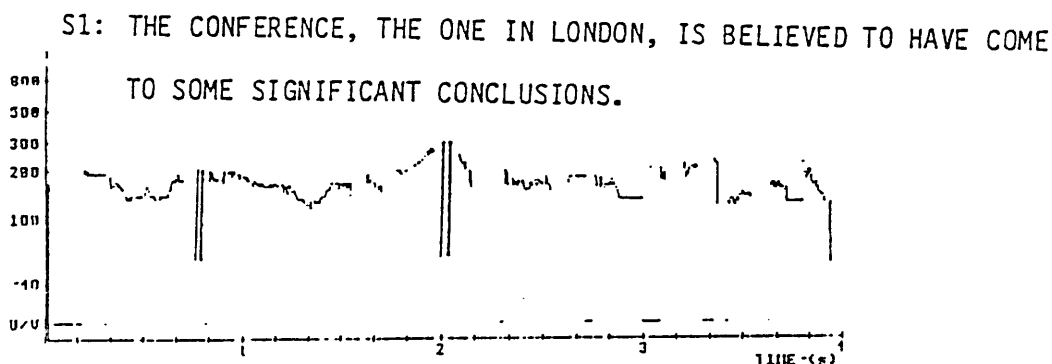
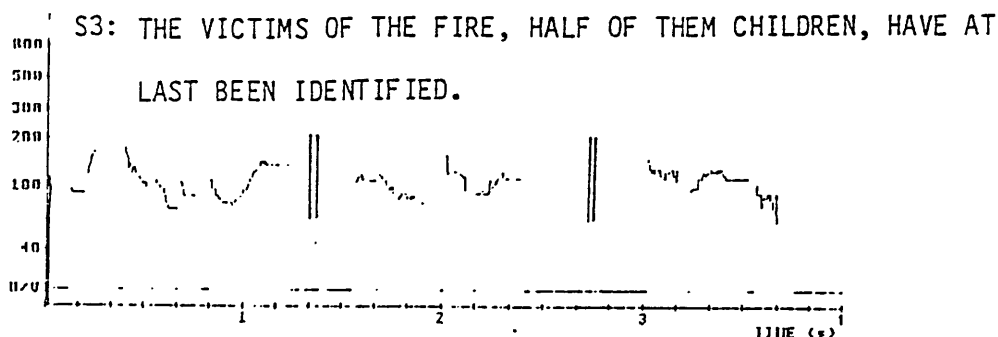
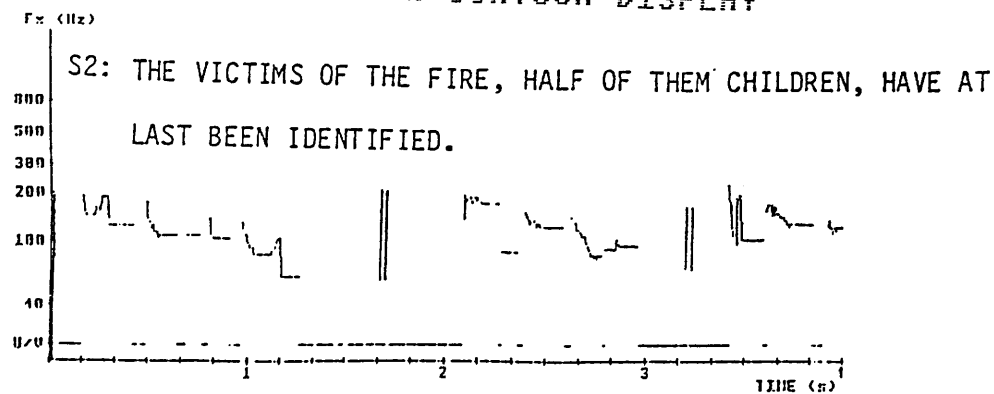


Figure Hv: Intonation contour displays indicating the occasional pitch change at appositional phrase boundaries.

INTONATION-CONTOUR-DISPLAY

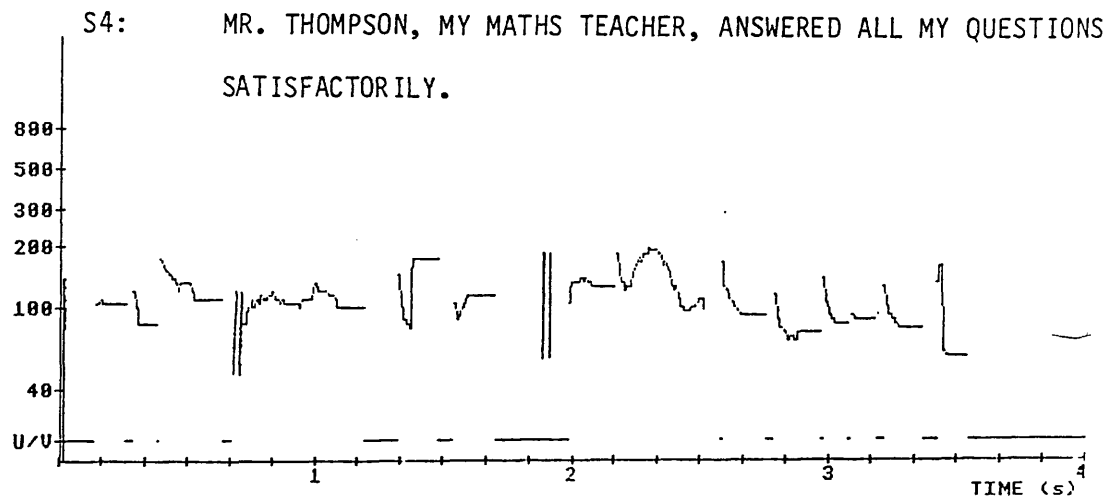
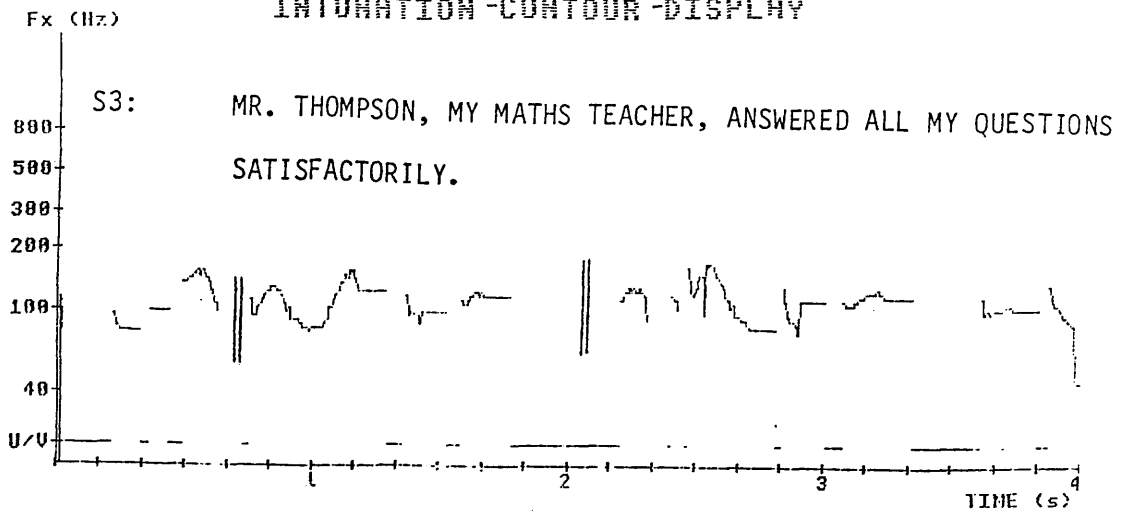


Figure Hvi: Intonation contour displays indicating the occasional lack of pitch change at appositional phrase boundaries.

Test I

Speech-Rate and Syllable-Duration.

In designing this Test, six sentences were included in the lists to be recorded by the native informants. The six sentences were not randomly distributed among words and sentences as in other Tests. They were included at the very end of the lists with an introductory heading in capital letters asking the informants to utter them once at their normal speech-rate, and once at a faster rate. (See materials for the Test, marked I in Appendix 2.)

The sentences were constructed in such a way as to include the three types of syllables: syllables with primary accents, unaccented syllables, and syllables with secondary accents. In terms of number, the lexicographically accented syllables were fewer than the unaccented syllables and the syllables with secondary accents were far fewer than either of them. Judging from the recording, a few unaccented monosyllables (e.g. MY, NOT) were actually accented; that was why they were classified as accented syllables.

The aim of the Test was to establish the durational changes that each of the three categories of syllable undergoes with the change of speech-rate. We were aware of some earlier literature (cf. Lehiste 1970:38) indicating that faster speech tempo was achieved mostly at the expense of unaccented syllables. We wanted to establish precisely how far each of the three categories of syllables was durationally reduced in a faster speech-rate. We wanted at the same time to find out whether those types of syllables showed margins of average durational differences among themselves in

such a limited chunk of speech. It was thought that a consistent average of durational difference among those categories in the two different speech-rates would be indicative of the importance of duration as a parameter reflecting the type of accent a syllable received.

Calculations of the averages were made in two ways:

I. The syllables constituting these sentences were lumped together in three groups according to the EPD marking. In this *sort* of calculation we had to allocate monosyllables to the group that suited them best. Some of these monosyllables were obviously accented and were therefore included in the group of accented syllables.

II In this sort of calculation, we followed the same procedure as in I, but the unaccented syllables that were, as argued more elaborately in Tests K and L below, no less prominent than the syllables marked with a secondary accent in the EPD were classified as receiving secondary accent.

In doing so, we wanted to find out whether or not the averages for the three types of accent would be significantly different from their counterparts in I. According to the way of calculation described in I above, the number of accented syllables was 131, the unaccented syllables 272 and the syllables with secondary accent 24 in the normal speech-rate. In the faster rate, a slight change in the number of accented and unaccented syllables took place for the following reasons:

- Two syllables were impossible to measure. One of these two syllables was an initial syllable in a sentence that started with a fricative / δ / of low amplitude that revealed no corresponding

blackness in the spectrogram. The other was a syllable that started with a plosive occurring after a pause within a sentence.

- Given words showed variations in the number of syllables in the normal and faster speech-rates. For instance, the -A- in the word ACTUALLY was elided more often in the faster speech-rate (see Appendices Ii and Iii). Similarly the -LL- in THEY'LL acted as a syllabic consonant more often in the normal speech-rate.

- The four informants showed variations in whether they accented a given monosyllable or not. For instance, PROVED was accented by all informants except for S2. Individual informants showed variations in this respect in the two rates of speech as well. In the sentence: "A HOT-POT IS QUITE ENOUGH FOR MY LUNCH", "MY" is accented by S2 in the normal speech-rate, but not so in the faster speech-rate.

Due to such variations, the number of accented syllables in the faster speech-rate was 123, and that of unaccented syllables was 271.

Results of the two ways of calculation are shown in the series of histogram Figures from Ii to Ix. The odd-numbered Figures represent the result of the way of calculation described in I, while the even-numbered ones represent the results of the way of calculation described in II. The pattern emerging from these Figures can be summarized as follows:

-According to the way of calculation described in I, the margin of difference between accented syllables and syllables with secondary accent in the normal speech-rate is always considerable. It ranges from 62 msec in the case of S4 to 93 msec in the case of S2 averaging 78 msec for the four informants. In the faster

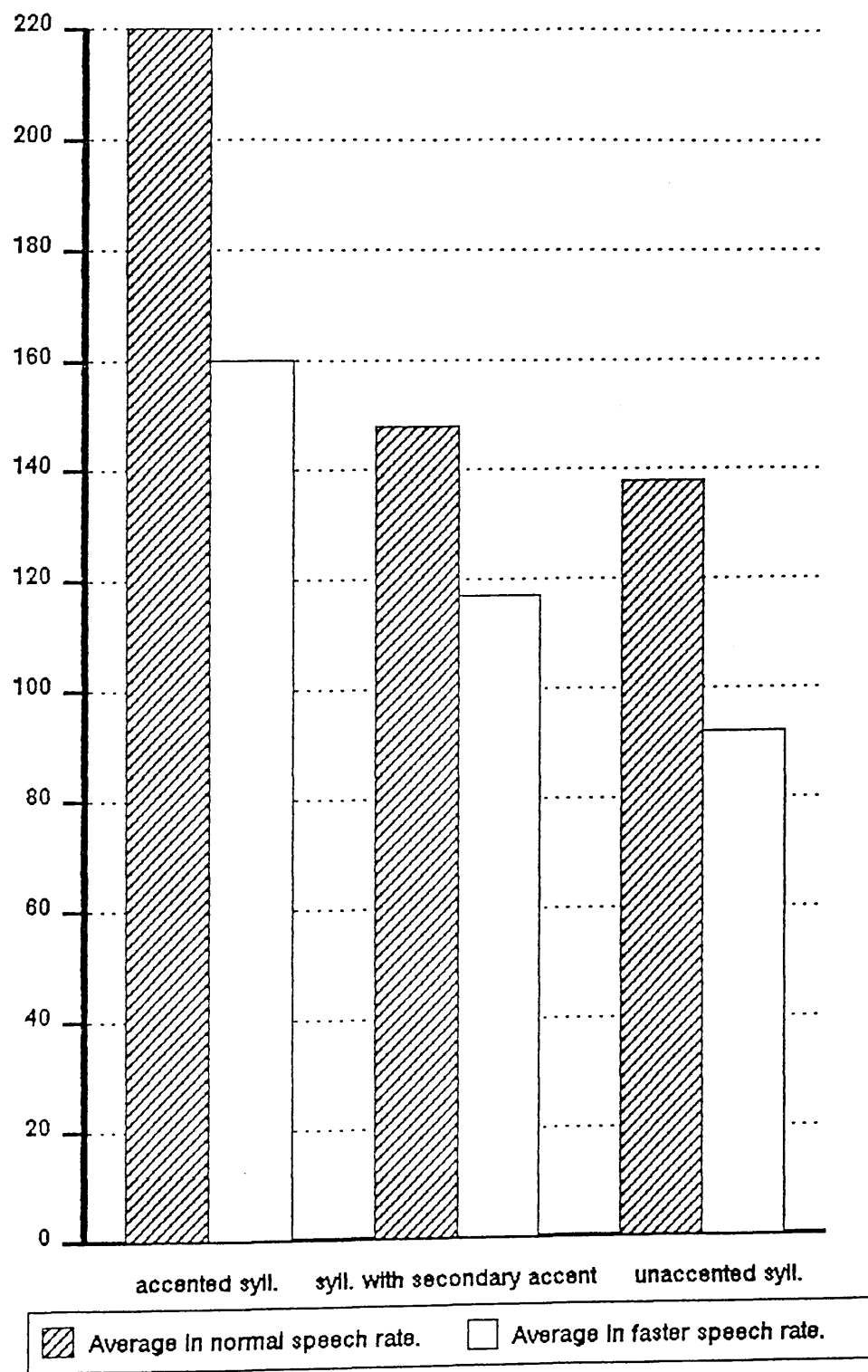


Figure Ii : Average duration in msec of syllables with different types of accent in normal and faster speech-rates for S1 (according to the EPD classification).

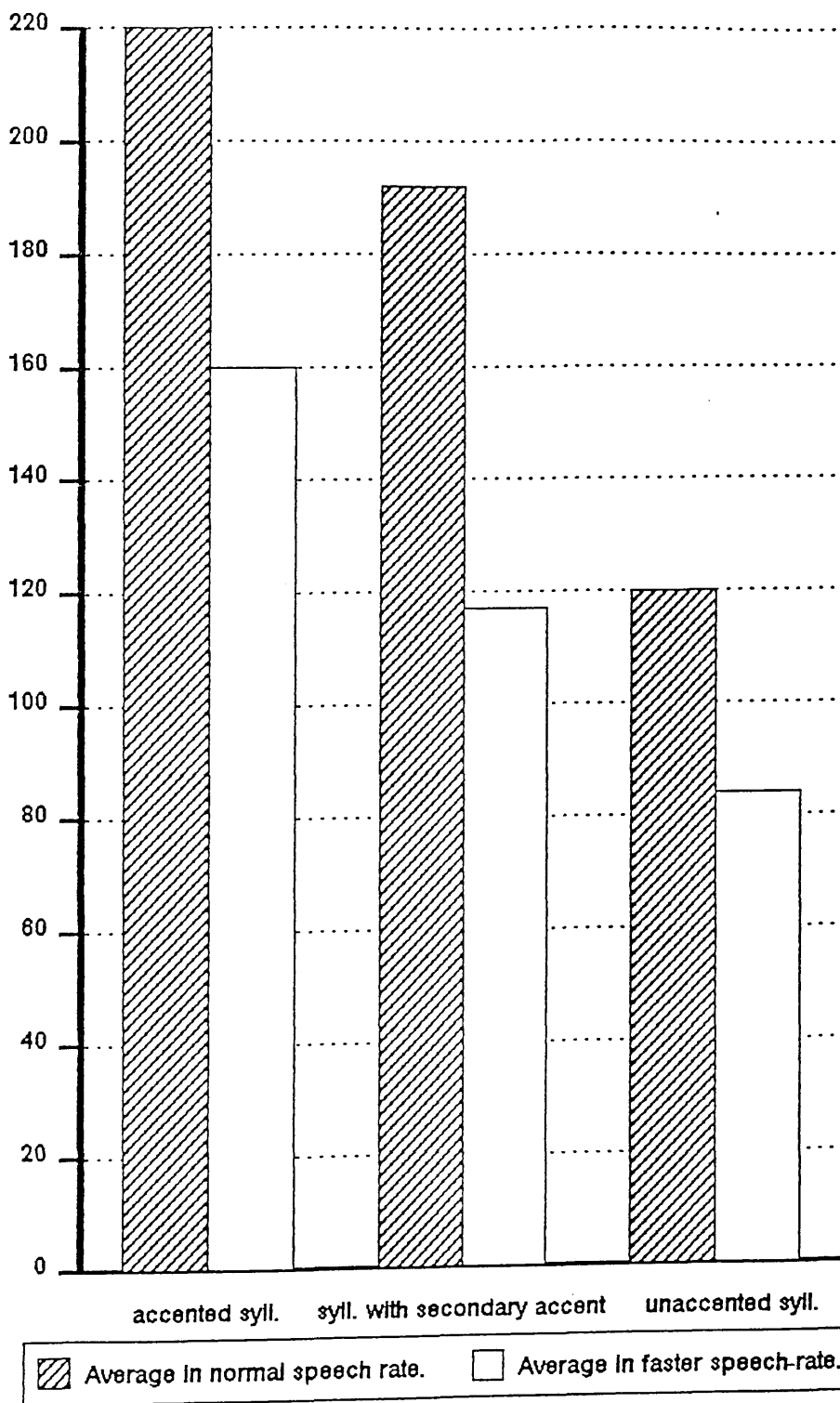


Figure Iii: Average duration in msec of syllables with different types of accent in normal and faster speech-rates for S1 (according to our proposed classification).

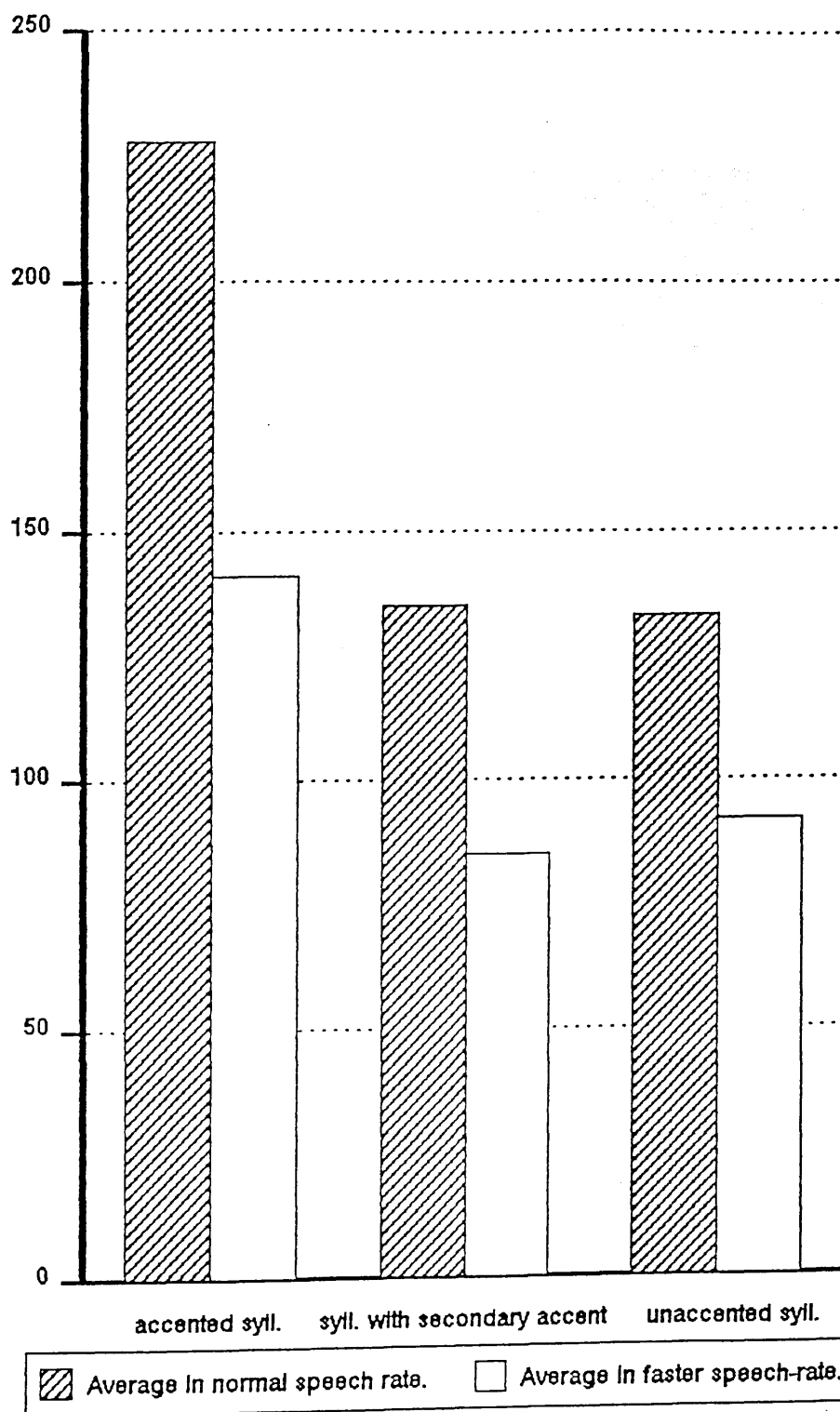


Figure Iiii: Average duration in msec of syllables with different types of accent in normal and faster speech-rates for S2 (according to the EPD classification).

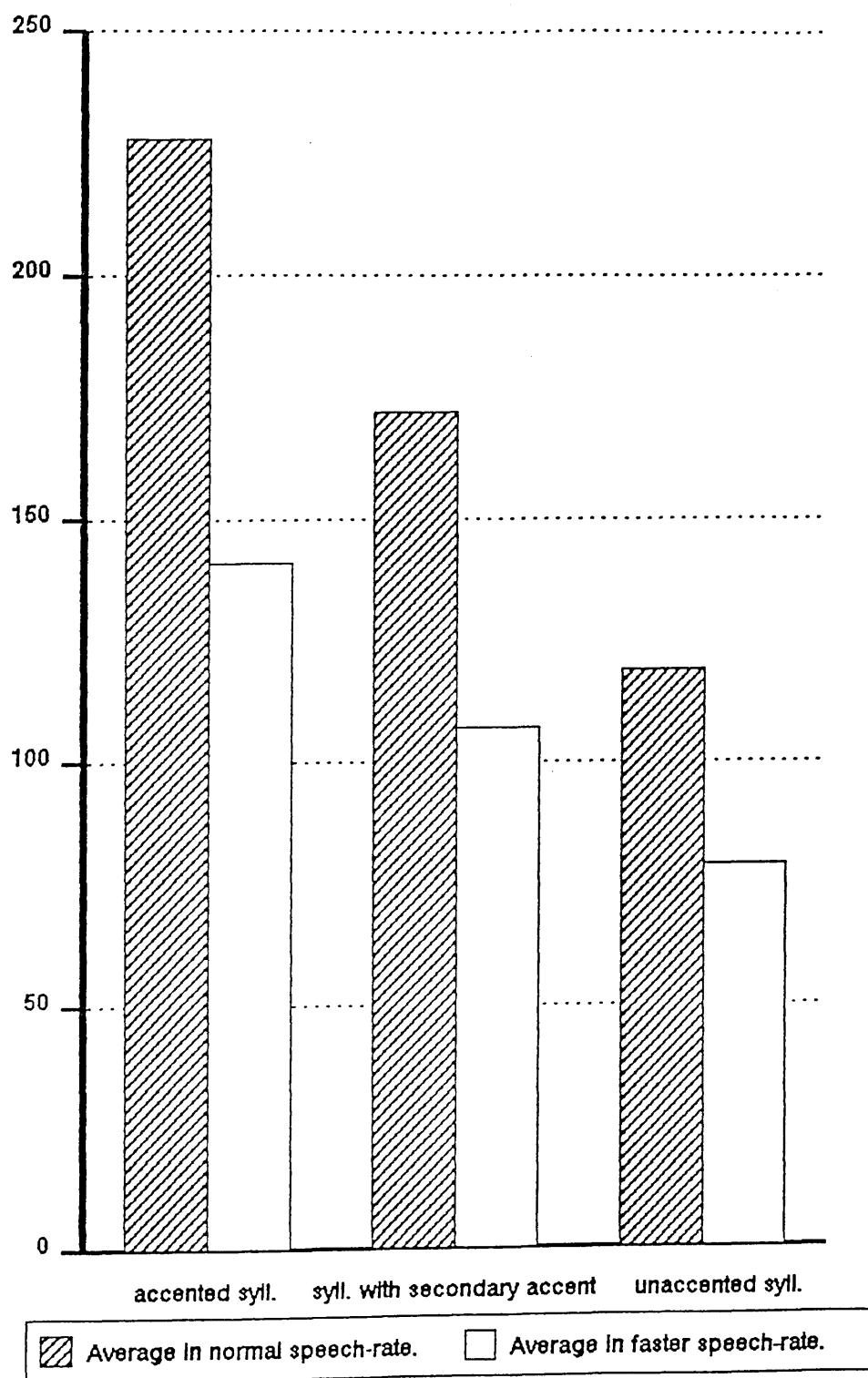


Figure Iiv: Average duration in msec of syllables with different types of accent in normal and faster speech-rates for S2 (according to our proposed classification).

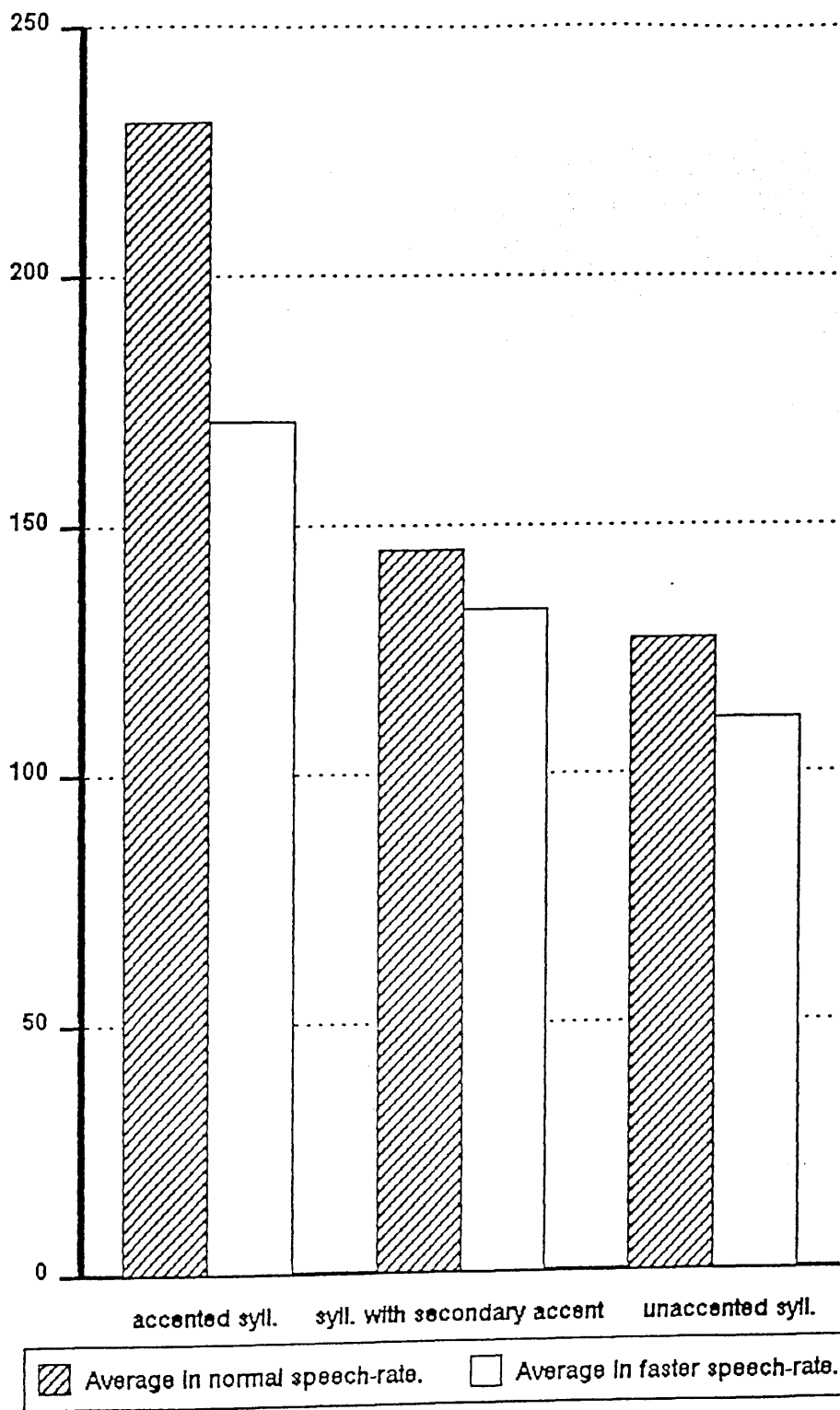


Figure Iv: Average duration in msec of syllables with different types of accent in normal and faster speech-rates for S3 (according to the EPD classification).

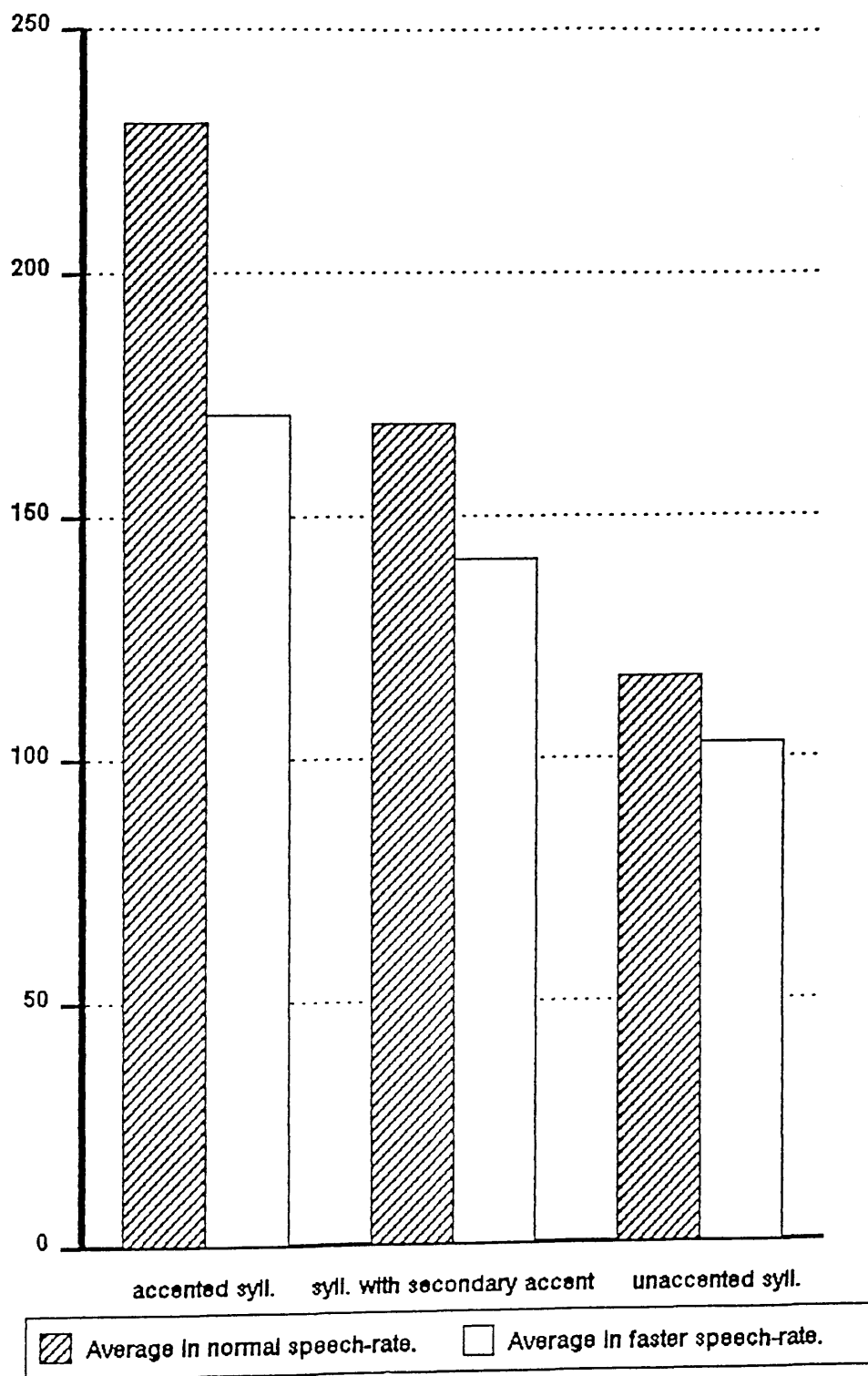


Figure Ivi: Average duration in msec of syllables with different types of accent in normal and faster speech-rates for S3 (according to our proposed classification).

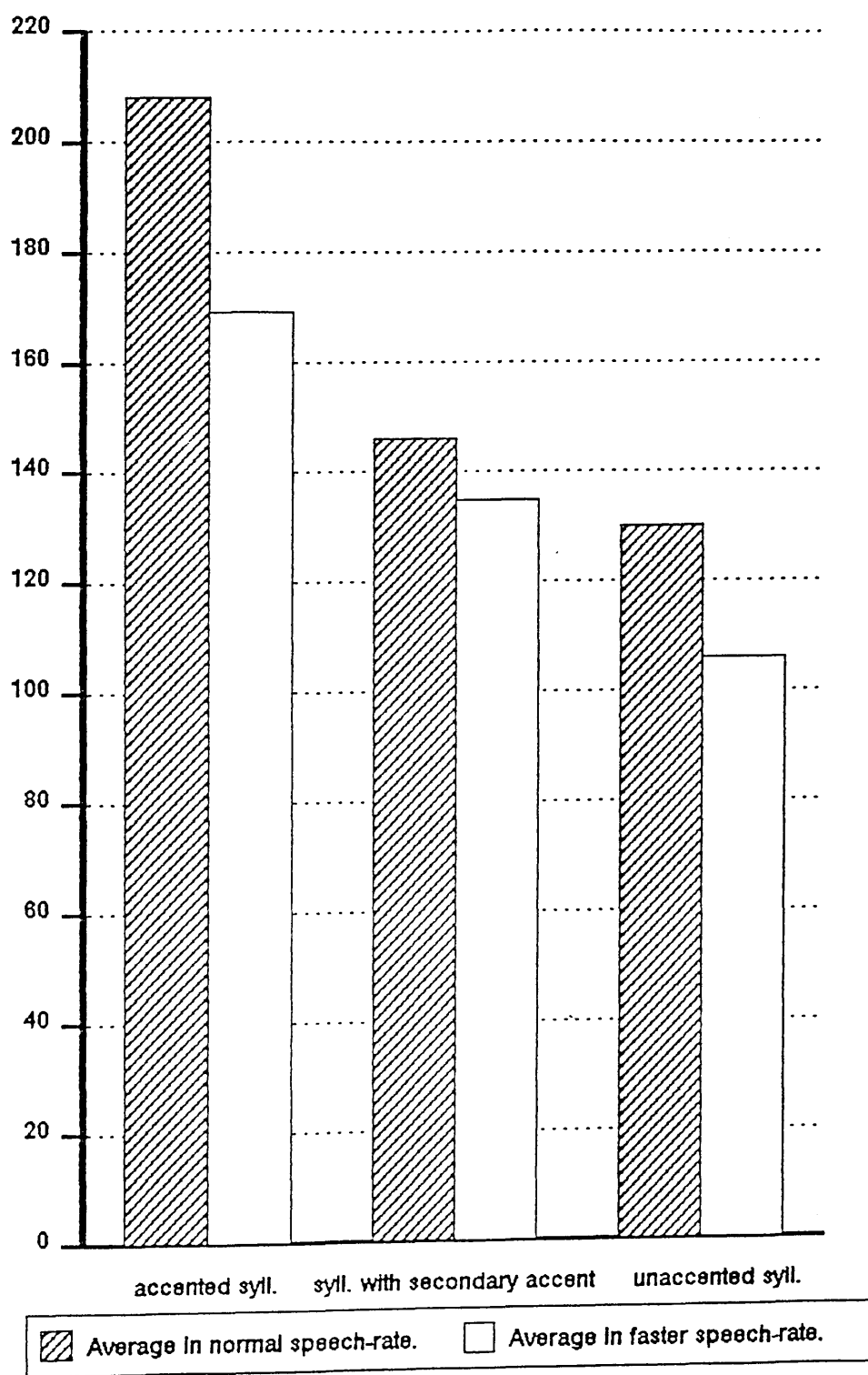


Figure Ivii: Average duration in msec of syllables with different types of accent in normal and faster speech-rates for S4 (according to the EPD classification).

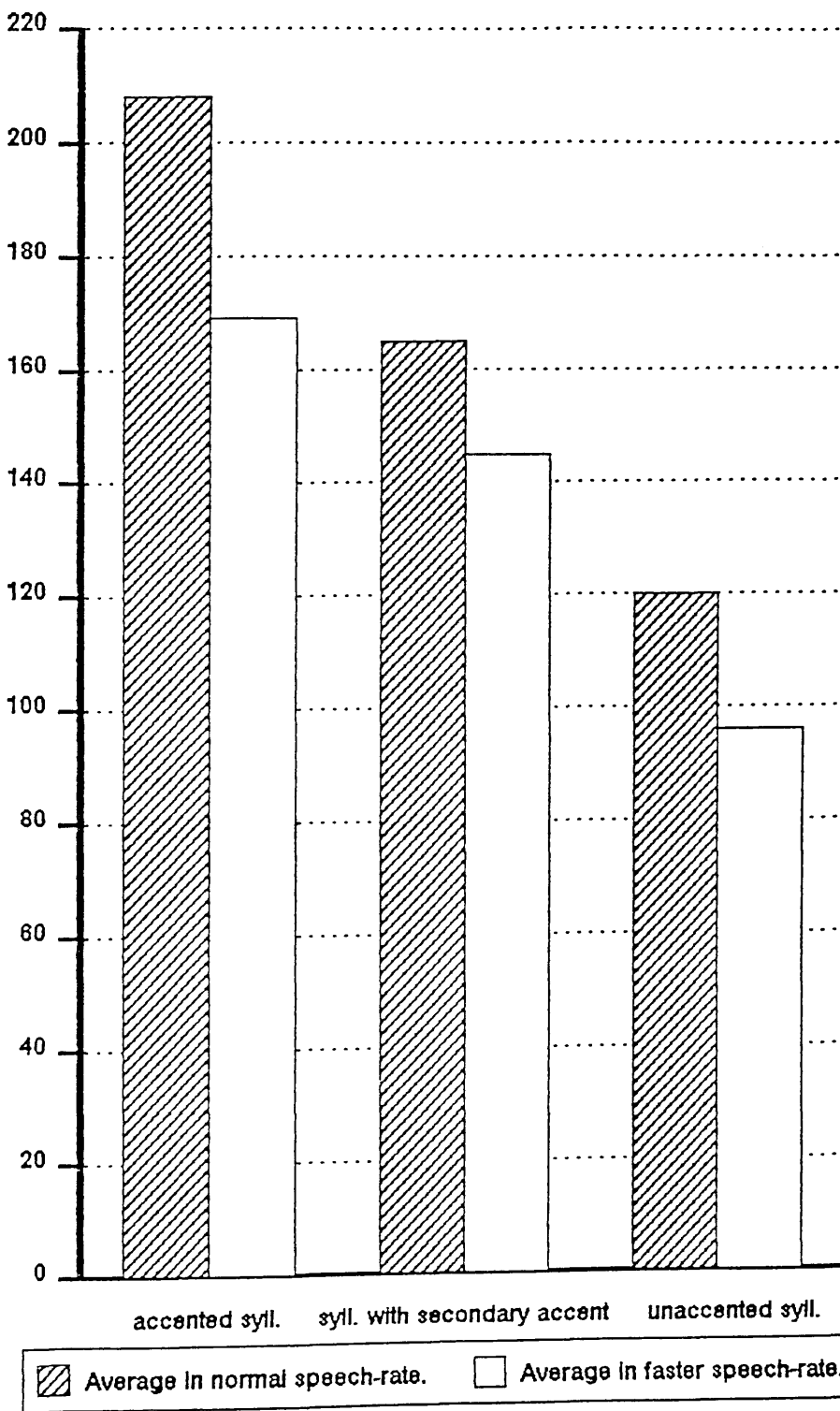


Figure Iviii: Average duration in msec of syllables with different types of accent in normal and faster speech-rates for S4 (according to our proposed classification.

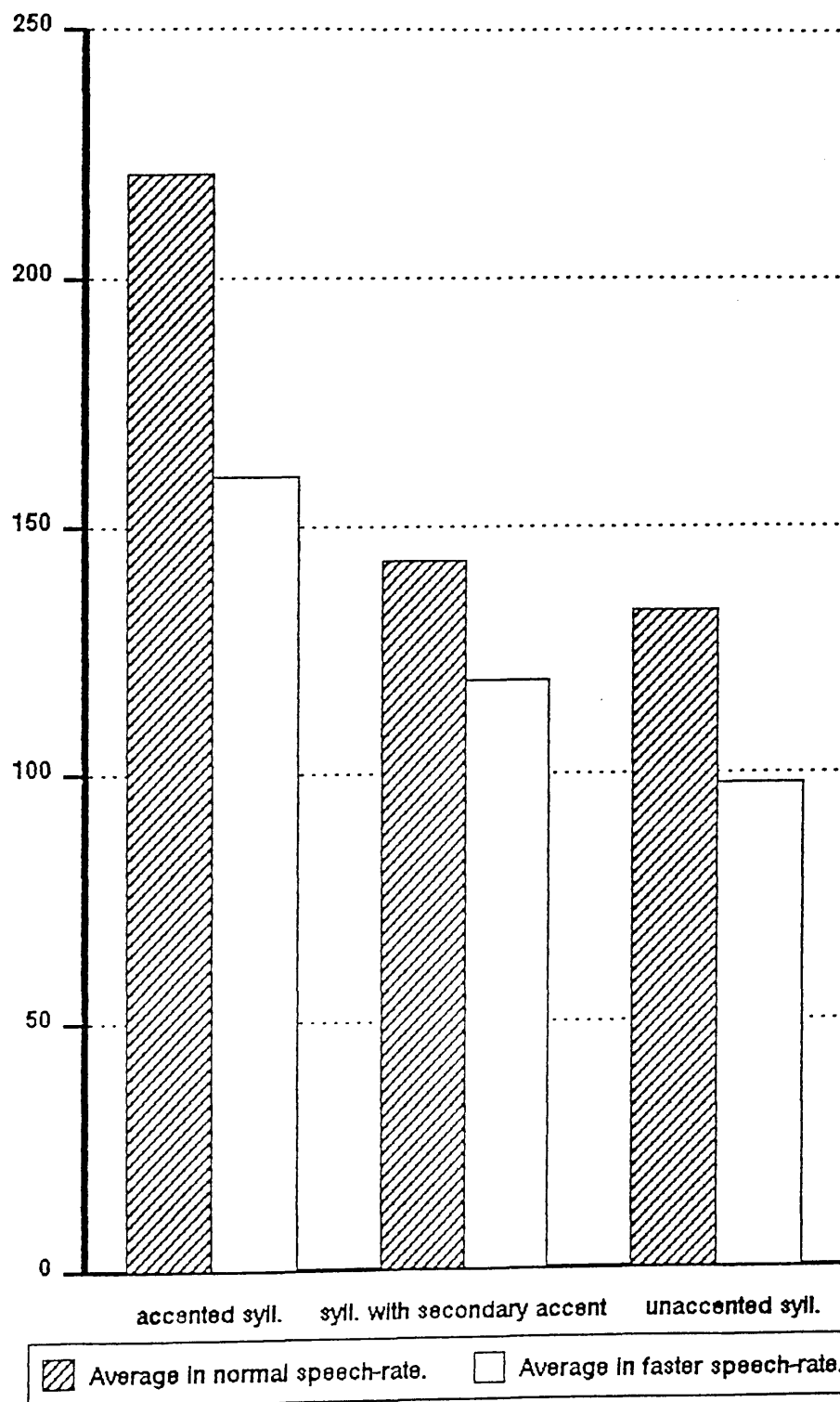


Figure Iix: Average duration in msec of syllables with different types of accent in normal and faster speech-rates for the four informants (according to the EPD classification).

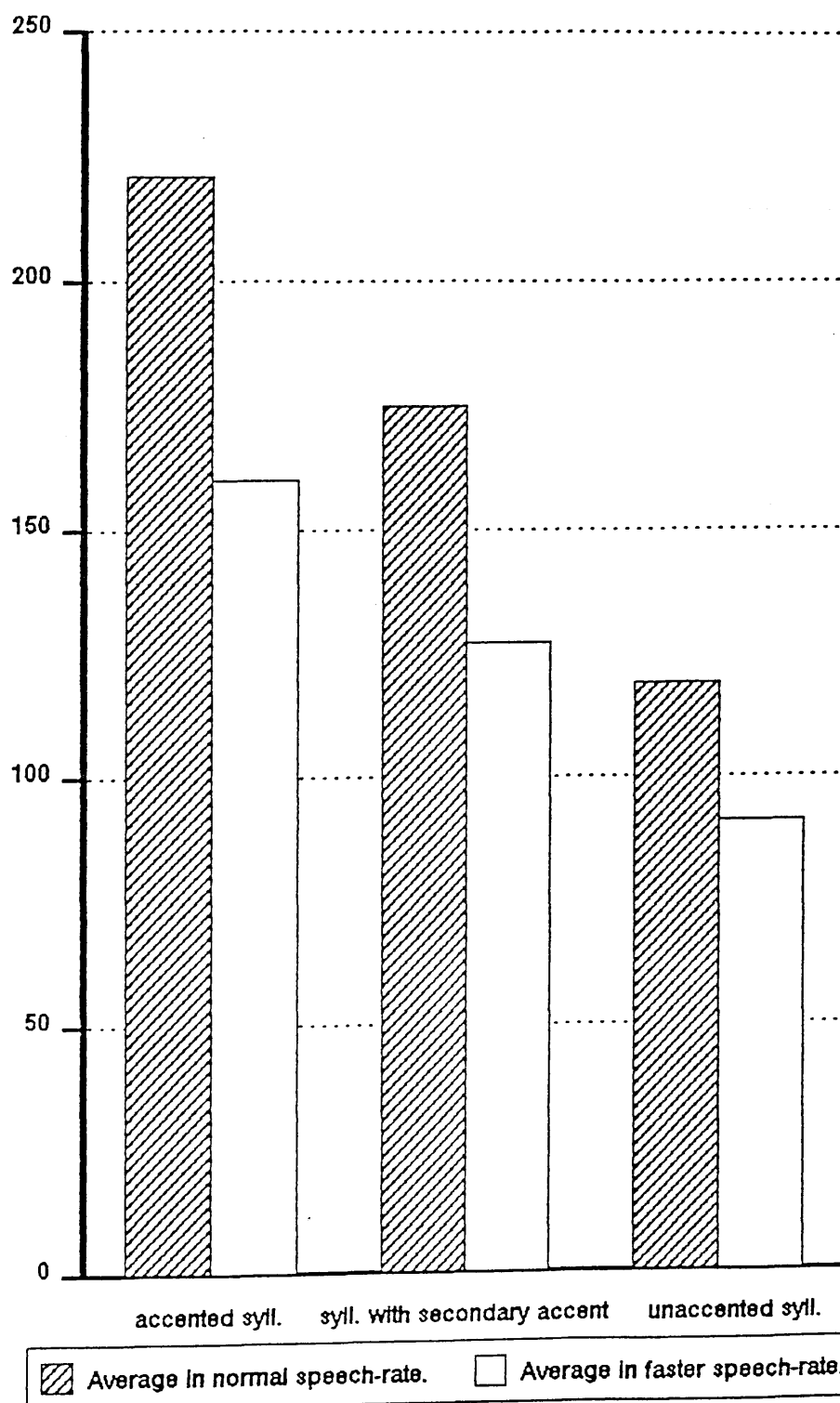


Figure IX: Average duration in msec of syllables with different types of accent in normal and faster speech-rates for the four informants (according to our proposed classification).

speech-rate, the margin of difference still in favour of accented syllables is there but it is understandably not that big as it ranges from only 34 msec in the case of S4 to 56 msec in the case of S2 averaging 42 msec for the four informants.

- The margin of difference between syllables with secondary accent and the unaccented syllables according to the way of calculation described in I is negligible. In the normal speech-rate, it ranges from as little as 2 msec in the case of S2 to 18 msec in the case of S3 averaging 11 msec for the four informants. In the faster speech-rate, it ranges from 22 msec in the case of S3 to 29 msec in the case of S4 averaging 25 msec for S1, S3 and S4. In the case of S2, unaccented syllables average 7 msec longer than syllables with secondary accent.

Thus, according to the EPD classification of syllables into the three types of accent, duration is a good correlate of accent only in so far as the distinction of accented syllables and syllables with secondary accent is concerned. According to that classification, syllable-duration appears as a negligible factor in distinguishing unaccented syllables and those with secondary accent. Figures ii, iii, v, vii and ix illustrate this very clearly.

- According to the way of calculation described in II, the margin of difference between accented syllables and those with secondary accent is also considerable. For no apparent reason, in the normal speech-rate, it is not within the JND in the case of S1 only. Thus it ranges from 28 msec in the case of S1 to 62 msec in the case of S3 averaging 46 msec for the four informants. In the faster speech-rate, it ranges from 24 msec in the case of S4 to 43 in the case of S1 averaging 33 msec for the four informants.

- The margin of difference between unaccented syllables and those with secondary accent according to the way of calculation described in II is more marked than it is according to the one described in I. In the normal speech-rate, it ranges from 45 msec in the case of S4 to 72 msec in the case of S2 averaging 58 msec for the four informants. In the faster speech-rate, it ranges from 28 msec in the case of S2 to 49 msec in the case of S4 averaging 36 msec for the four informants.

Thus according to our proposed classification of syllables into the three types of accent, duration is a good correlate of accent not only in so far as the distinction of accented syllables and those with secondary accent is concerned but also in distinguishing the latter type of syllables from the unaccented ones. This is clear in Figures Iii, iv, vi, viii and x. This set of Figures is obviously more favourable than Figures Ii, iii, v, vii and ix if duration plays a significant role in the distinction of the three types of accent. The discussion in this Test is based on the syllable-by-syllable values given in Appendices Ii, and Iii. In these two appendices, * stands for accented syllables, ^ for syllables with secondary accent, ~ for unaccented syllables, and ? for syllables that are treated as unaccented according to the EPD classification and, alternatively, are included as syllables with secondary accent in our proposed one.

There is nothing in these results to support the suggestions made in some earlier literature (cf. Lehiste 1970:38) that durational reduction resulting in faster speech-rates is mostly done at the expense of unaccented syllables. Indeed, the drop in the durational average from normal to faster speech-rate is 27%

approximately for accented syllables, 16% for syllables with secondary accent according to the way of calculation described in I, 27% according to the one described in II, and 26% for unaccented syllables according to the former and 23% according to the latter. According to the latter calculation, the drop for the three types of syllable is almost equal. One point of caution that has to be made here, however, is that these results can be stressed only in so far as the scope of the Test would allow for generalization. Besides, this is one of the Tests where we could not have complied with our general plan of making the target syllables identical in terms of the syntagmatic and paradigmatic structure. Such a plan, no doubt, is extremely far from applicable in this respect.

Test J

Extra-Strong Accent

In designing this Test, 5 words were selected from the EPD. Each word of these was included in the lists of individual words to be recorded by the informants. At the same time, they were embedded in sentences in such a way as to put them into contrast with one another or with a non-target word. In this way, each target word would undergo a shift of accent to a syllable that is not lexicographically accented (e.g. [\]UNCOMFORTABLE rather than UN[\]COMFORTABLE). An example of such sentences was:

I SAID HARMLESS, NOT HARMFUL.

where the underlined words are the target ones. The accents these words receive are contrastive accents (see the Sub-section on accent and contrast in Chapter I page 27) and these are subsumable under what we call "extra-strong accent".

The aims of the Test were as follows:

- i. to find out if syllable-duration was a consistent parameter of extra-strong accent.
- ii. to establish the average margin of durational difference, if any, in favour of the syllables with extra-strong accent over the unaccented tokens of such syllables. It was thought that it would be significant to compare such an average with the average obtained on comparing accented syllables with unaccented ones in Test D above. Margins of difference between the durations of target syllables in one-word utterances and those of their tokens in longer utterances are shown in Table J (derived from Appendix J).

It was hypothesized that if syllable-duration were to be a good correlate of accent, then extra-strong accent could be more consistently reflected by duration. Moreover, it was thought that syllables receiving extra-strong accent compared to their own unaccented tokens would average a durational difference of greater magnitude than would the normally accented syllables (i.e. those that do not receive extra-strong accent) compared with their own unaccented tokens.

The results of the Test can be analysed on two different axes as follows:

- 1) The variations in the durations of the syllables that receive the extra-strong accent (e.g. HARMFUL)
- 2) The variations in the durations of the syllables that lexicographically receive the accent (e.g. HARMFUL) and are now supposed to have undergone an accentual demotion (in this case, a shift of accent away from them).

In the 20 cases of comparison in (1), syllables with extra-

strong accent were longer than their unaccented tokens in 16 cases. The average margin of difference was 80 msec. This is clearly a big margin in view of the fact that the average margin of difference between normally accented syllables and unaccented syllables in Test D is only 49 msec. Note that unaccented syllables compared in this Test fall into the category we call "syllables with secondary-like accent". This is why we refer here to the average margin based only on the comparisons of the Second Set of Test D.

In the 20 cases of comparison in (2), syllables that were accentually demoted were found to be shorter than their accented tokens in 16 cases. The average margin of difference was 76 msec. Thus, the lexicographically unaccented syllables become markedly longer when they receive the extra-strong accent and the lexicographically accented syllables become on average shorter by more or less the same margin of difference as a result of the shift of accent away from them.

Word	S1		S2		S3		S4	
HARMLESS	>78	<128	>135	>109	>51	<40	<32	<183
HARMFUL	>26	<14	>41	<43	>8	<101	>19	<55
COMPREHEND	<108	>179	<67	>72	<79	>118	<162	<63
REPREHEND	<59	>289	<77	<109	>19	>56	<83	<13
UNCOMFORTABLE	>14	>57	>39	>21	<26	>18	<63	>53

Table J: Margins of durational difference between long utterance syllable-tokens (of words with accentual shifts) compared with one-word utterance ones.

Words in One-Word and Longer Utterances

In designing this Test, 45 words from the lists of individual words were embedded in sentences. Some of these sentences were constructed with a view to letting the target words or rather the lexicographically accented syllables in those words) receive the tonic accent, or one of the tonic accents in the sentence: e.g.

THE IMPERCEPTIBILITY OF SUCH THINGS IS QUITE UNDERSTANDABLE.
(where the target word is the one underlined). Conversely, other sentences were constructed with a view to preventing the target word from receiving a tonic accent: e.g.

I DID RESUSCITATE THE PATIENT IMMEDIATELY BEFORE THE INJECTION.

It should be noted that resorting to syntax to achieve variation in the type of accent a word receives was by no means successful in all cases. In most cases, though, words received tonic or non-tonic primary accents as planned, and deviations from the plan did not affect the outcome of the Test but, conversely, helped to achieve the degree of variation aimed at. Table Ki shows how frequent the uniformity and how rare the disagreement among the four informants was in assigning those two types of accent (marked * and x respectively).

Some words (MISUNDERSTAND, STAND UP, and MENDING) were used in more than one sentence, or more than once in the same sentence. Each word of those was compared to each longer utterance token apart. This is the explanation for those words appearing in Table Ki more than once.

The purpose of this Test was to find out whether there were enough durational variations to justify the phonological distinction

of so-called "word-accent" and "sentence-accent". Through syllable-to-syllable and word-to-word comparisons between one-word utterances on the one hand and longer utterances on the other, we attempted to establish patterns for potential variations that might or might not be ascribed to the occurrence of the items compared in a one-word utterance or a longer utterance (henceforth called "word domain" and "sentence domain" respectively to avoid confusion).

Lack of reasonable correlation between the durational structure of words in the word domain on the one hand and that in sentence domain on the other would be assumed to support the phonological distinction in question. This distinction is based on the assumption that accent in the word domain is no more than a potential for accent in the sentence domain (Jassem and Gibbon 1980; Bolinger 1958a). This implies that accent in the word domain is a mere abstraction that is rendered concrete by the big and diverse pitch fluctuations in the sentence domain and by the concomitant durational and amplitude variations. In the light of this argument, variations in the durational structure of words in the sentence domain should be marked enough from that in the word domain to distinguish so-called sentence-accent from word-accent.

If, on the other hand, syllable durations in the word domain are correlative to their counterparts in the sentence domain, and if significant durational variations, if any, are attributable to any other factor such as syllable-position, then the distinction in question will be regarded as implausible. If these two conditions (or either of them) were found to exist, they would support an underlying assumption of this thesis that pitch prominence is not assigned to a sentence on a syllable-by-syllable basis, but rather

characterizes stretches of speech that are longer than the syllable. Pitch-concomitant durational variations would only be supra-syllabic and the accent-duration relationship would prove to function in the sentence domain in the same way as it does in the word domain. Durations of syllables in the word domain and their counterparts in the sentence domain are provided in Appendix K. Table Ki below is based on the values in that Appendix. It gives the margins of difference in favour of (<) or against (>) the syllable token in the sentence domain as compared with its counterparts in the word domain. That Table also indicates the type of accent a given syllable receives. The type of accent a syllable receives is decided as follows:

- i if a syllable receives a secondary accent in the EPD, it is shown with a secondary accent in the Table (marked by ^)
- ii if the syllable has a vocalic nucleus that is judged as a full quality vowel, we classify it as receiving a secondary accent, but mark it differently by ?
- iii remaining unaccented syllables according to the EPD, excluding those described in ii are regarded as unaccented (marked by ~)
- iv syllables receiving primary accents in the EPD are classified into two types:
 - primary tonic (marked by * in the Table)
 - primary non-tonic (marked by x in the Table)

Classifying syllables with primary accents into either of those two types was carried out according to the degree of prominence each given syllable received in the sentence. This was decided subjectively by the present investigator and checked by a professional phonetician who is a native speaker of English.

Syllable	S1	S2	S3	S4
UN	~ >23	~ >8	~ >9	~ <24
DER	~ >7	~ <35	~ <28	~ >4
STAN	* >60	* <1	* >52	* >78
DA	~ >23	~ >15	~ >6	~ >15
BLE	~ >25	~ <12	~ >26	~ <34
E	~ >3	~ >8	~ <26	~ <30
LEC	~ >7	~ <32	~ >20	* >4
TRO	? >8	~ >39	? >4	? <34
CHE	x >65	x >21	x >48	x >37
MI	~ <3	~ 0	~ >8	~ >14
STRY	~ <69	~ <60	~ >90	~ >102
FUL	? >22	? >24	? >13	? >4
FIL	x >47	x >121	x >212	x >79

Table Ki :Margins of difference of syllable-to-syllable comparisons of the target words in long utterances and their one-word utterance counterparts.

- * Comparisons involving syllables with tonic accent
- x Comparisons involving syllables with primary non-tonic accent
- ~ Comparisons of syllables with EPD marked secondary accent
- ? Comparisons of syllables with secondary-like accent
- ~ Comparisons of unaccented syllables

N.B. Underlined values are those where the individual word token is shorter than its longer utterance counterpart.

Syllable	S1	S2	S3	S4
MIS	^ <20	^ >33	^ <19	^ >4
UN	? >17	? >11	? <38	? <2
DER	~ >13	~ 0	~ >6	~ <35
STAND	* >231	* >136	* >25	* >18
LON	x >75	* <29	x >59	x <12
DON	~ >115	~ >71	~ >120	~ >60
FIL	? >26	? <1	? <6	? >24
TRA	* >10	* >18	* >21	* >23
TION	~ >91	~ >97	~ >40	~ >152
STAND	? >82	? <9	? >100	? >64
UP	* >2	* <51	x >56	* <45
VER	~ >84	~ <18	~ <70	~ <10
SI	~ >23	~ >20	~ >67	~ >56
FI	~ <5	~ <31	~ <27	~ <1
CA	* <4	* >13	* <1	* <8
TION	~ >110	~ >1	~ >60	~ >110
MA	~ >2	~ <11	~ <6	~ <66
CHINE	* >140	* >32	* <49	* >120

Syllable	S1	S2	S3	S4
GUN(S)	? >37	? >15	? <u><12</u>	? <u><60</u>
MEN	? <u><16</u>	? >13	? <u><10</u>	? <47
TA	* >45	* >55	* >8	* >36
LI	~ >3	~ <u><11</u>	~ <u><11</u>	~ >3
TY	~ >113	~ >44	~ >38	~ <5
SEN	x >31	x >78	x >45	x >95
DING	~ >127	~ >95	~ >160	~ >75
WHERE	? >41	? >56	? >18	? <u><2</u>
BY	x >246	x >82	x >158	x >86
RE	~ >5	~ <u><33</u>	~ 0	~ <u><15</u>
SU	x >21	x <u><6</u>	x >9	x >10
SCI	~ >62	~ <u><38</u>	~ >7	~ >8
TATE	? >64	? <u><17</u>	? >79	? >23
UN	x >7	x >52	* >7	x >4
DER	~ >22	~ >18	~ >13	~ >47
WEAR	? >86	? >46	? <u><6</u>	? <u><32</u>
LOCH	? <u><42</u>	? >34	? <u><156</u>	? <u><26</u>
LE	* >32	* >6	* >2	* <u><12</u>

Syllable	S1	S2	S3	S4
VEN	~ >32	~ <4	~ >44	~ <37
MEN	* >89	* >46	* >30	x >26
TAL	~ >98	~ >81	~ >145	~ >141
AIR	* <63	* <48	* <57	* <76
PORT	? >117	? <6	? >122	? >101
HARM	x >12	* >51	* >14	* >2
FUL	? >135	? >75	? <1	? >84
MEAL	* <20	* <31	* >27	* <92
TIME	? >29	? <9	? >23	? <57
SPE	* <43	x <7	x >45	* >20
CI	~ >23	~ <21	~ >23	~ >26
FY	? >71	? >16	? >94	? >19
SPEN	x >89	x >106	x >86	* >14
DING	~ >270	~ >36	~ >49	~ >14
RE	~ >44	~ >15	~ >8	~ >17
TURN	x >140	x >262	x >217	x >151
SAR	? <30	? <36	? <26	? <6
CAS	x >91	* <15	* <3	x >18

Syllable	S1	S2	S3	S4
TIC	~ >97	~ >65	~ >120	~ >72
SPE	~ <u><54</u>	~ <u><11</u>	~ <u><11</u>	~ >14
CI	~ >4	~ <u><17</u>	~ >2	~ <u><2</u>
FI	~ <8	~ >1	~ >4	~ >29
CA	* >27	* >5	* >39	* >5
TION(S)	~ <u><67</u>	~ <u><18</u>	~ <u><29</u>	~ >6
AR	x >35	x >32	* >32	x >22
TIST	~ >149	~ >133	~ >119	~ >115
LAND	* >88	* <u><12</u>	* >24	* >37
LORD	? >45	? >64	? >131	? >130
FUN	x >32	x <u><62</u>	x <u><47</u>	x >13
DA	~ >14	~ <u><12</u>	~ <u><40</u>	~ >12
MENT(S)	~ >15	~ <15	~ 0	~ <124
SAR	* >1	* >18	* <u><52</u>	* <u><69</u>
CA	~ >33	~ >10	~ <u>>1</u>	~ >14
SM	~ >51	~ >63	~ >72	~ >31
A	x >9	* <u><11</u>	* <u><61</u>	x <u><34</u>
VA	~ >33	~ >10	~ >4	~ <u><14</u>

Syllable	S1	S2	S3	S4
LANCHE	? >172	? >58	? >210	? >108
AR	* >38	* <70	* <31	* <33
CHI	~ >1	~ >34	~ >51	~ <u><3</u>
TECT	? >78	? >92	? >57	? >31
RUMP	~ <u><24</u>	~ >21	x <u><39</u>	~ <u><23</u>
TI	~ <u><3</u>	~ >10	~ >27	~ >25
TUM	x >89	* >82	? <u><60</u>	x <u><35</u>
MIL	? >12	? <u><47</u>	? <u><21</u>	? <u><3</u>
TO	x >133	x >29	x >29	x >5
NIC	~ <u><69</u>	~ >32	~ >36	~ >6
MEN	-	x >73	x >101	x >86
DING	-	~ >98	~ >27	~ >128
STAND	* >20	* >19	* >62	* <3
STILL	? >102	? >26	? <u><20</u>	? >18
MOUTH	x <u><15</u>	x >32	x >62	x <u><8</u>
OR	~ >37	~ >88	~ >45	~ >15
GAN	~ >134	~ <u><56</u>	~ >96	~ >52
NEW	? >25	? <u><44</u>	? >21	? >20

Syllabel	S1	S2	S3	S4
TON	* >44	x <u><8</u>	x >27	x >15
IAN	~ >145	~ >14	~ >38	~ >7
FUN	~ <16	~ <29	~ <71	~ >12
DA	~ >50	~ <7	~ <34	~ >4
MEN	x <u><8</u>	* <u><32</u>	* >15	x >45
TAL(S)	~ >24	~ >37	~ <u><69</u>	~ >82
RUM	? >8	? <u><1</u>	? >12	? <u><29</u>
BUS	x <u><4</u>	* <u><21</u>	* <u><8</u>	x >38
TIOUS	~ >93	~ >144	~ >192	~ >64
MILL	~ <u><14</u>	~ <u><86</u>	~ >13	~ <u><2</u>
IO	~ >15	~ <u><4</u>	~ <u><21</u>	~ >31
NAI	x <u><46</u>	x >13	x <u><6</u>	x >77
RESS	? >33	? >82	? >90	? >163
OR	x >67	x >47	x >17	x >9
GAN	~ >169	~ <u><12</u>	~ >109	~ >22
LEN	* >11	* <u><19</u>	x >44	x >72
DING	~ >146	~ >31	~ >60	~ >62
AU	? <u><13</u>	? >18	? <u><42</u>	? <u><28</u>

Syllable	S1	S2	S3	S4
GUST	x >124	x >34	x >100	* <9
HOT	* >52	* <122	* <33	* <30
POT	? >24	? <140	? >44	? >14
FOOL	x <14	x >97	x <5	x >2
PROOF	? >7	? >79	? >56	? >19
NON	x >7	x >32	x <56	x <5
STOP	* >48	* >23	* >83	* >24
STAND	? >109	? >17	? >99	? >87
UP	* <12	* >12	* >36	* >27
MIS	~ >11	~ >6	~ <5	~ <7
UN	? >19	? <21	? <5	? <8
DER	~ >10	~ <13	~ <3	~ <8
STAND	* >157	* <42	* <19	* <116
MIS	~ <22	~ <65	~ <44	~ >9
UN	? <2	? <25	? <28	? <8
DER	~ >7	~ <36	~ <15	~ <28
STAND	* >98	* <66	* >27	* <79
STAND	? >123	? >14	? >116	? >54

Syllable	S1	S2	S3	S4
UP	x >51	* >51	x <52	x >7
MEN	-	x >72	x >67	x >65
DING	-	~ >104	~ >86	~ >101

N.B. Some of the words whose constituting syllables are included in this Table occur in more than one sentence in the material. References are made in the footnote to Appendix K to the sentences constituting the tokens of such words.

Figures Kii to Kvi show the average margins of difference syllables in the sentence domain with each type of accent have, both when they are shorter and when they are longer than their counterparts in the word domain. Comparing the four Figures for individual informants, we can detect slight differences among corresponding averages for each individual informant. Those Figures show that the ">" average margin of difference is greater than the "<" one for all types of accent with the one exception of the ">^" margin which is smaller than the "<^" one.

Deviating from this pattern are the following cases:

- The ">^" margin for S1 is greater than the "<^" one.
- The ">*" and "<*" average margins for S2 are equal.
- The "<*" margin for S4 is greater than the ">*" one.

This pattern correlates well with the numbers of syllables (Table Kvii). We notice in that Table that the numbers of the ">" cases, like their average margins, are greater than those for the "<" ones. The only exception again is the number of the ">^" which is fewer than that for ">^".

Figure Kvi gives the general averages of margins of difference

based on the preceding four Figures for each individual informant. This Figure, together with Table Kvii, can be interpreted as follows:

- Syllable tokens in the sentence domain, at least in our data, tend to be on average shorter than their counterparts in the word domain. This is true in terms of the magnitude of both the margins of difference and of the number of individual syllables being shorter (66 vs 38 syll in the case of *, 78 vs 21 syll. in the case of x, 75 vs 48 syll. in the case of ?, 137 vs 55 syll. in the case of ~). The only exception is the case of the >^ syllables the average margin of which is smaller than that of the <^ syllables and so is their number (19 vs 23 syll.).
- The >* and <* margins are so close (39 msec vs 37 msec respectively), and both are just below the JND. This indicates that syllables with primary accents that receive a tonic accent in the sentence domain can equally be shorter or longer than their counterparts in the word domain. The fact that the >* and <* averages are close and that both are below the JND suggests that since the type of accent such syllables receive is the same in the word and sentence domains (i.e. primary tonic accent) the durational variations they undergo are possible only within imperceptible limits. This point becomes clearer on comparing the pattern of durational variations these syllables show with that shown by the x syllables as described below.
- The >^ and <^ show on average close margins of difference as well (24 msec for >^ vs 29 msec for <^). This indicates that the EPD-marked secondary accents show no strong preference to be either shorter or longer in the sentence domain than they are in the word

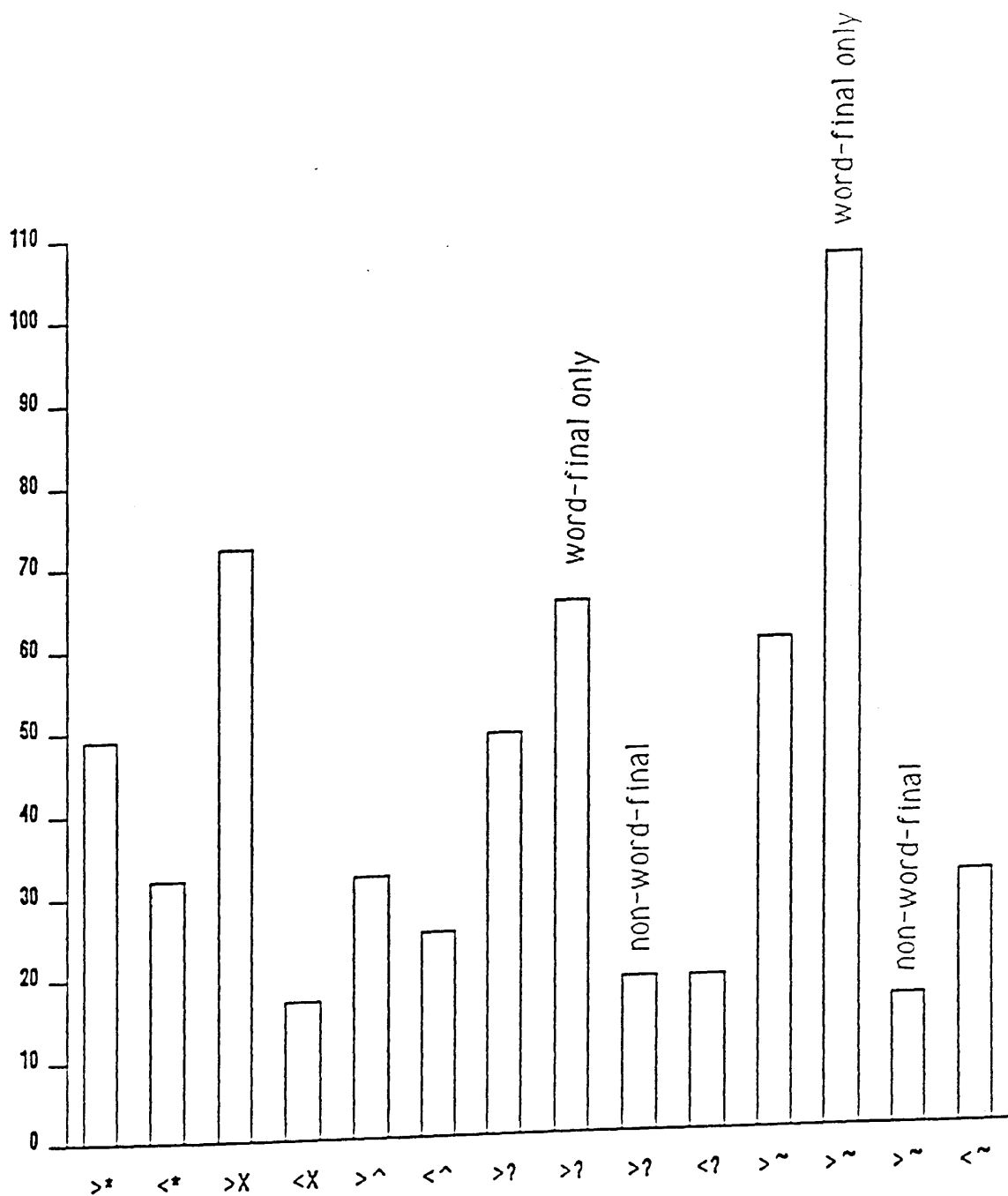


Figure Kii: Average margins of durational difference in msec of syllables with different types of accent in long utterances as compared with their counterparts in one-word utterances for S1.

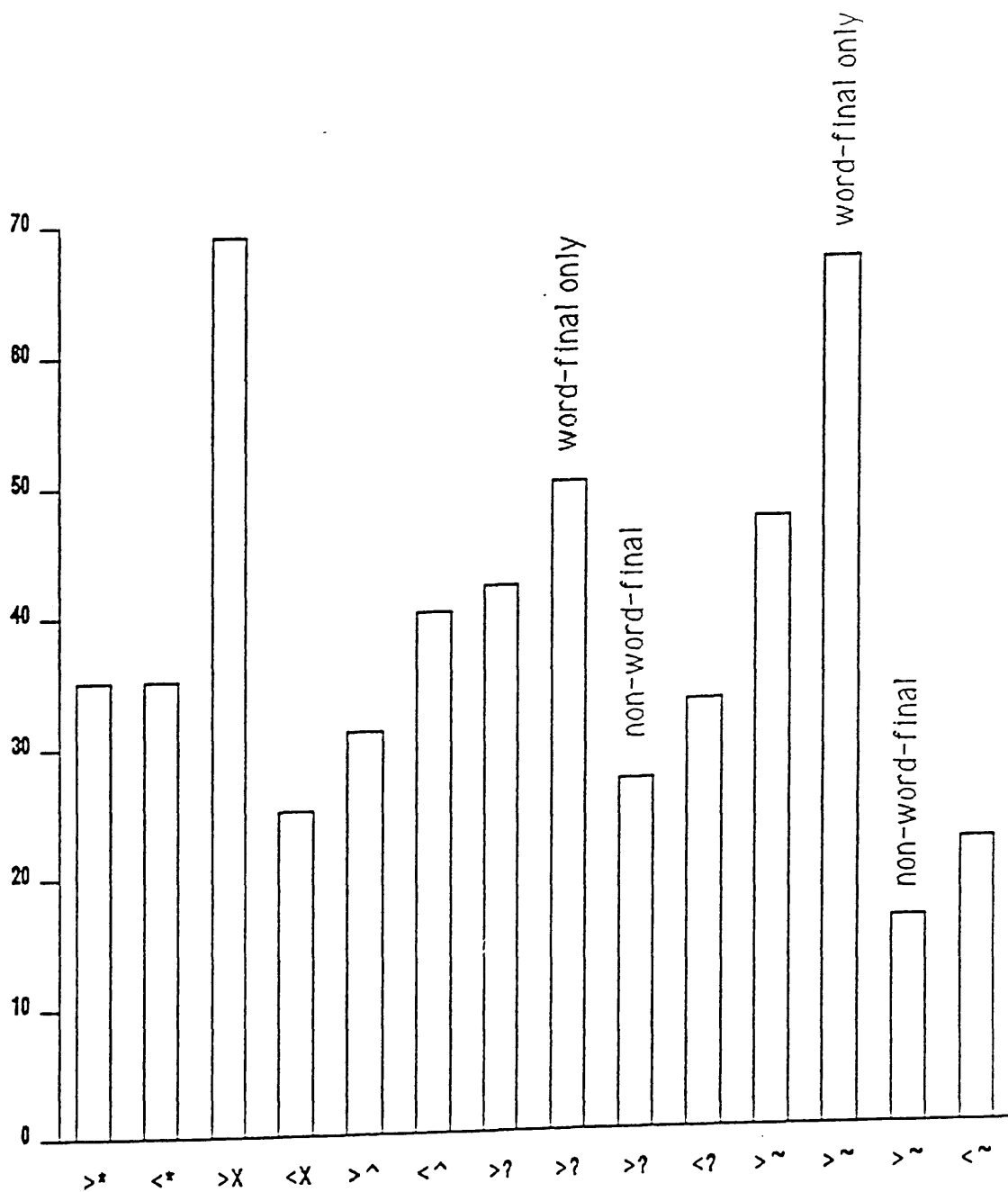


Figure Kiii: Average margins of durational difference in msec of syllables with different types of accent in long utterances as compared with their counterparts in one-word utterances for S2.

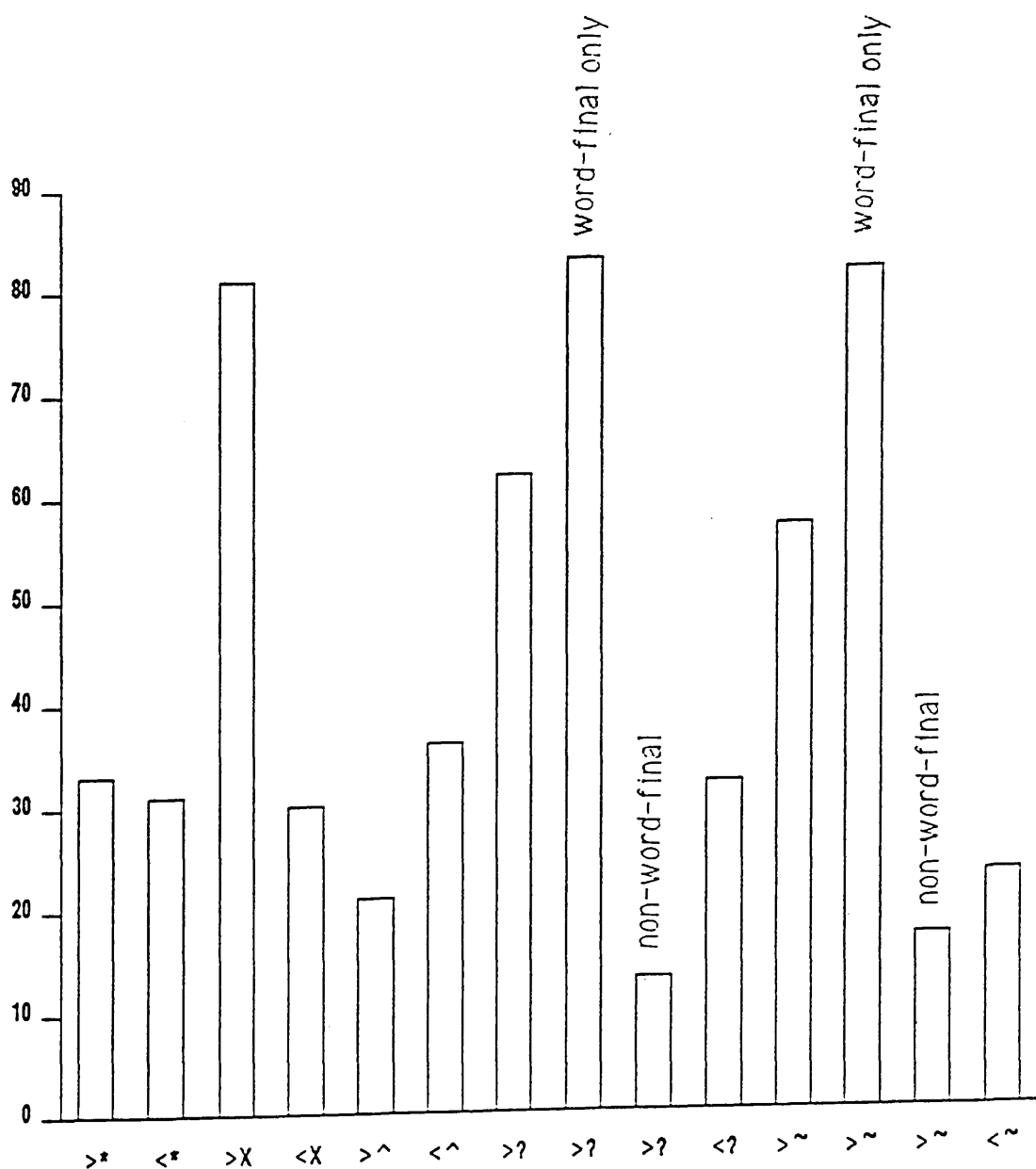


Figure Kiv: Average margins of durational difference in msec of syllables with different types of accent in long utterances as compared with their counterparts in one-word utterances for S3.

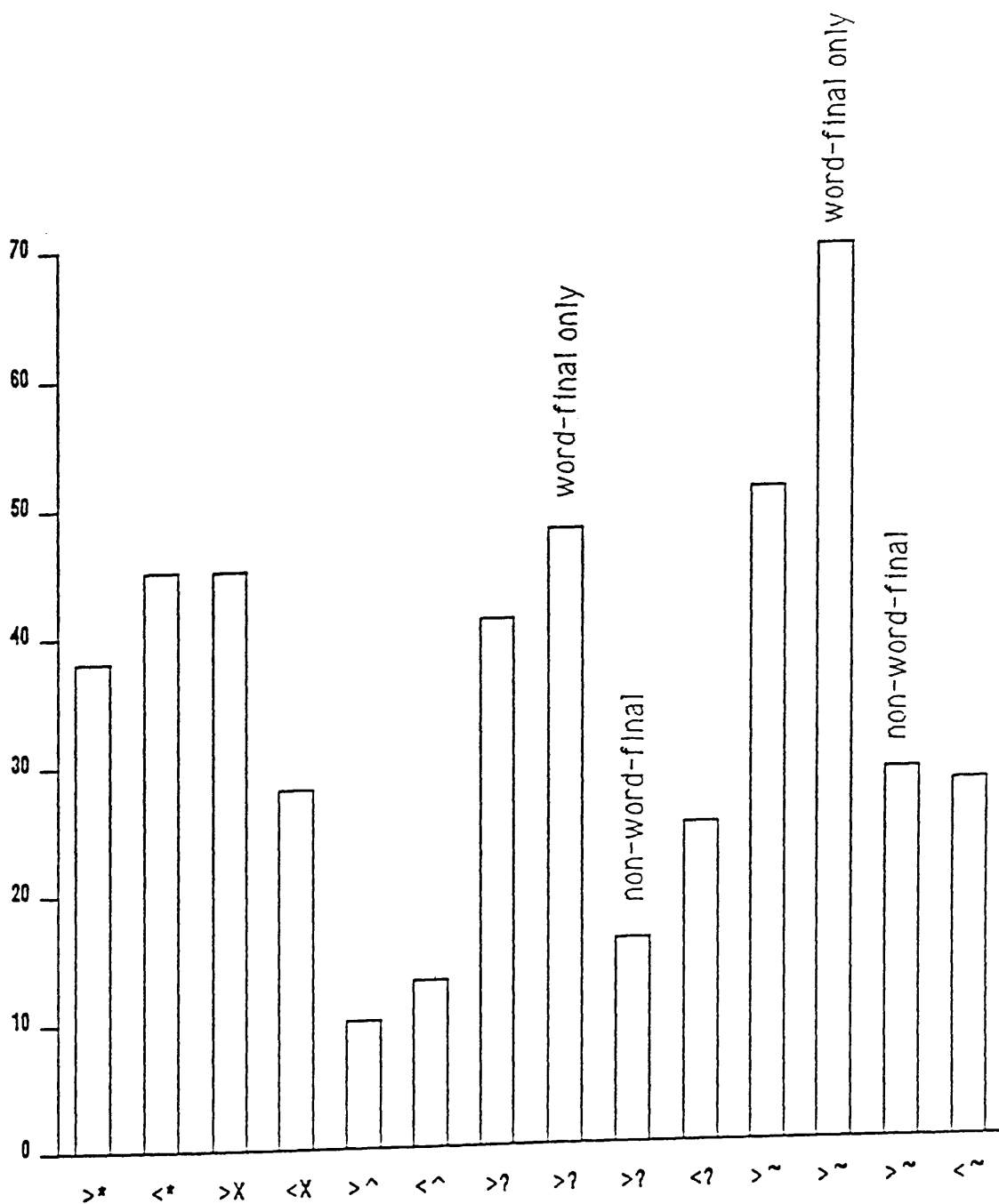


Figure Kv: Average margins of durational difference in msec of syllables with different types of accent in long utterances as compared with their counterparts in one-word utterances for S4.

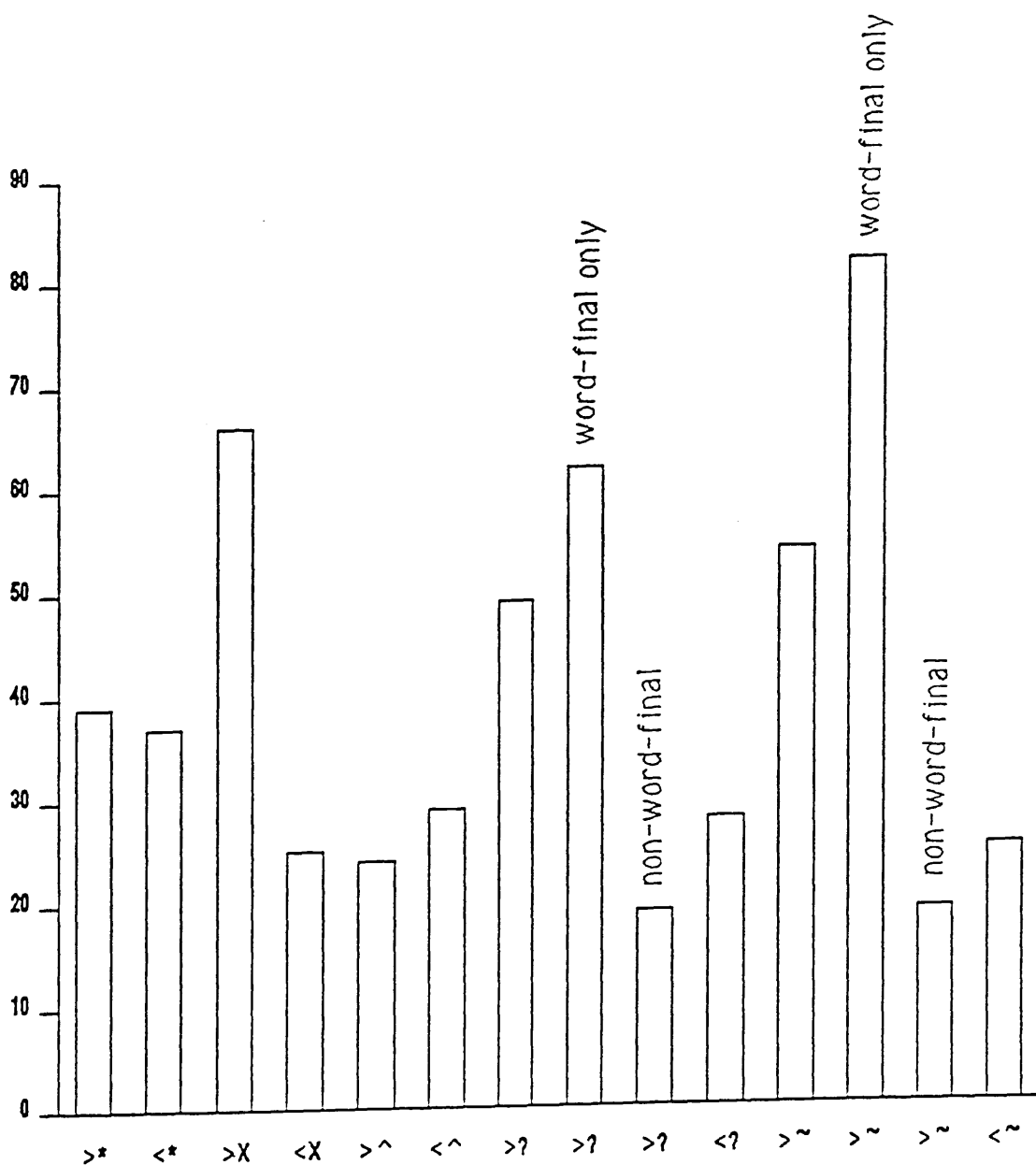


Figure Kvi: Average margins of durational difference in msec of syllables with different types of accent in long utterances as compared with their counterparts in one-word utterances for the four informants jointly.

domain.

They show variations either way and well below the threshold of perception. Syllables of this type are different from other types of syllables in that their > margins and numbers are slightly smaller than their < ones. A possible explanation of this deviation from the general pattern could be that these syllables are fewer in number than other types (^ syllables are 42 in number, * are 99, x are 104, ? are 123, and ~ are 192). It could well be that since they are fewer in number, their margins of difference are less reliable than those of other types.

- Durational variations also occur in the case of the syllables with the x, ? and ~ types of accent. Significant variations of these are discussed below. The < variations for those types are all well below the JND ranging from 25 msec in the case of <~ and <x to 28 msec in the case of <?. The number of syllables showing the < variations are fewer than those showing the > ones. These syllables include some sentence domain tokens in the case of the final syllables of those words that have an extra /s/ or /z/ (i.e. FUNDAMENTS, SPECIFICATIONS, FUNDAMENTALS, and MACHINEGUNS).

- Significant (above the JND) patterns of variations are on average those where the tokens in the sentence domain are shorter than their counterparts in the word domain in the types of accent marked x, ? and ~. These significant variations can be ascribed to two factors: I A change in the type of accent. For Bolinger (1958a) and for Jassem and Gibbon (1980), a syllable lexicographically marked with a primary accent in a word is no more than a potential "locus" for receiving a sentence-accent. For us, such a syllable receives a primary tonic accent if the word is said individually. In the

sentence domain, such a syllable has two possibilities with regard to the type of accent it receives:

- i. either it maintains its tonic accent by receiving the sentence tonic or one of the tonics in the sentence, in which case the durational variations it undergoes are only possible within imperceptible limits.
- ii. or it does not receive a sentence tonic, in which case it continues to receive a primary accent that is non-tonic. The change of the accent type such a syllable undergoes in this case from primary tonic in the word domain to primary non-tonic in the sentence domain is bound to be reflected in durational variations that are at least over the threshold of perception. Results of this test strongly support this assumption of ours. The average margin of difference for the >x syllables as shown by Figure Kvi is 66 msec, that is, well over the JND. All informants are consistent in keeping a perceptible margin ranging from 45 msec in the case of S4 to 81 in the case of S3. By comparison, the margin of difference for the >* syllables is above the JND only in the case of S1 and goes as low as 33 msec in the case of S3. The fact that only syllables with primary non-tonic accent (as compared with those receiving primary tonic accent) in long utterances are shorter than their counterparts in one-word utterances is further replicated by the comparisons included in Table Kviii below. Accented syllables only are compared in that Table. Whereas only 53.1% of syllables with primary tonic accent in long utterances are shorter than their counterparts in one-word utterances with an average of 19 msec, 96.8% of syllables with primary non-tonic accent are shorter than their counterparts with an average of 59 msec.

It should be added that those margins referred to above existed, though we did not adopt the intonational classification of syllables with lexicographical primary accent into:

- Syllables receiving sentence-accents (i.e. those occurring in words that are more prominent than others in the same sentence)
- Syllables that do not receive sentence-accents (though they are lexicographically accented) because they occur in words that are less prominent compared to others in the same sentence. This supports our view that what counts in a polysyllabic word is the relative prominence a syllable receives in comparison with other syllables in the same word. Sentence prominence which we tentatively ascribe to pitch alone does not appear to have hampered our calculations since the resulting margins are found to be over the JND both in the case of the individual informants as well as in the case of the general averages.

The only counter-evidence to the analysis offered above is that there are a few syllables (21 out of 99 * syllables) which are longer in the sentence domain than in the word domain. One of these involved an instance of misaccenting: S3 assigns a primary non-tonic accent, rather than the lexicographic secondary accent to the first syllable of RUMPTITUM in the sentence domain token only. Other examples clearly involve a change of tempo where all the syllables of certain words were longer in the sentence domain tokens (e.g. RESUSCITATE for S2). This is true also of some disyllabic and trisyllabic words in which only the final syllables are found to be shorter than their counterparts (e.g. AVALANCHE for S4 - the tendency to shorten word-final syllables in the sentence domain is discussed in II below). Not all cases, however, have possible

explanations like these, but the fact that they are few and that their average margin of difference is well below the JND renders the counter-evidence relatively inconsequential.

II Syllable-position: Appendix K and Table Ki based upon it show clearly that word-final syllables tend to be shorter in the sentence domain than in the word domain especially if the target word does not occur in a breath-group-final or a sentence-final position, and if no change of speech-rate was involved. Compare for instance the margins for the final syllable in MISUNDERSTAND in the sentence: HOPEFULLY, NOBODY'LL MISUNDERSTAND WHAT WERE'RE TRYING TO DO (where it is tonic but the target word is not breath-group-final) to its counterpart in: HE SHOULD'NT KEEP ON SAYING THE WORD MISUNDERSTAND. Word-final shortening in the sentence domain is clear also in STAND UP in the sentence: I DON'T MEAN YOU SHOULD STAND UP, and in the sentence tokens of MEALTIME, SPECIFICATIONS, RUMPTITUM, UNDERWEAR, etc.

This tendency to shorten the word-final syllable in the sentence domain accounts for the fact that the ? and ~ syllables show margins of difference that are over the JND (49 msec for >?, and 54 msec for >~). The plausibility of this explanation is further confirmed by separating the margins of difference for word-final syllables from those for non-word-final ones. In this sort of calculation the >? average margin rises from 49 msec to 62 msec and the >~ one to 82 msec. Margins for non-word-final syllables drop to 19 msec in both cases of >? and >~. Thus, the shortening of word-final syllables in the sentence domain accounts for two out of the three instances where sentence token syllables show considerable margins of difference. The number of word-final syllables showing the > variations is also

greater than that for the non-word-final syllables showing the same variations (129 vs 83 syll. respectively). It should be indicated that the tendency for word-final syllables to be shorter in long sentences is even maintained in some of the cases where the sentence token has the extra /s/ or /z/ in the words: FUNDAMENTS, SPECIFICATIONS, FUNDAMENTALS, and MACHINEGUNS.

Testing the effect of syllable-position on the magnitude of the margins of difference shown by syllables receiving primary non-tonic accent in the sentence domain (by excluding word-final instances) we found that the non-word-final syllables maintained a 48 msec margin of difference, that is to say, a margin of difference that was still above the JND.

To sum up the discussion of these results we can say that:

- In the sentence domain (as compared to the word domain) syllables show durational variations that are mostly below the threshold of perception. In fact the variations discussed above, excluding those caused by changes in syllable-position or accent type, are possible within various tokens of the same word. Compare, for instance, the two sentence domain tokens of MENDING, or the three of STAND UP, or the three of MISUNDERSTAND. Our data show that the numbers of syllables showing the > variations are relatively greater, as are the margins of difference.
- Considerable margins of difference exist in the >x, >? and >~ cases. These were found to be due to:
 1. Change in the type of accent: Syllables receiving the primary non-tonic accent in the sentence domain, and undergoing the > variations have margins of difference that are on average over the JND. This is due to the change in the type of accent they receive

from the primary tonic in the word domain to the primary non-tonic in the sentence domain.

2. Syllable-position: Word-final syllables tend to be considerably shorter in the sentence domain if they are not breath-group-final or sentence-final ones.

The two types of accent involved in 1 are not exclusive to the sentence domain. Both are possible in the word domain:

e.g. 'SUB₁CLASSIFI₂CATION, 'TRANSOCE₁'ANIC,
'EX₁TERRI₂TORIAL, 'TRANS₁CONTI₂NENTAL,
'EXTRA₁TERRI₂TORIAL.

Factor 1 alone, therefore, does not justify the dissociation of so-called word-accent and sentence-accent since the two "seem" to maintain the same relation to the physical parameters. At least we can say for sure that in the light of the foregoing results they maintain the same relation to duration (i.e. the one parameter investigated in detail in this study).

Factor 2 (i.e. change of syllable-position) is one that functions both in the word domain and in the sentence domain. We have seen in Test D above how the syllable-position factor sometimes overrides the accent-duration relationship. Word-final syllables were found to be longer than word-initial ones even if the latter were accented and the former were not. The difference between the word domain and the sentence domain is that it is the breath-group-final or sentence-final syllables or words that have the same attribute. A word-final syllable that is at the same time a breath-group final or a sentence-final one maintains that attribute.

To conclude, as far as duration alone is concerned, the distinction of so-called "word-accent" and "sentence-accent" has

Type of Accent	Long Utterance Token Shorter or Longer	Number of Syllables				Total
		S1	S2	S3	S4	
*	>	20	15	17	14	66
*	<	4	14	10	10	38
x	>	20	17	19	22	78
x	<	5	5	5	6	21
~	>	5	5	4	5	19
~	<	6	6	6	5	23
?	>	25	18	17	15	75
?	>	16	12	12	12	52
word- final only						
?	>	9	6	5	3	23
non- word final						
?	<	6	12	15	15	48
~	>	39	28	34	36	137
~	>	19	17	21	20	77
word- final only						
~	>	20	11	13	16	60
non- word final						
~	<	8	20	13	14	55

Table Kvii: Numbers of syllables with different types of accent according to the patterns of durational variations they undergo from one-word utterances to longer utterances.

One-word Utterances	Words in Longer Utterances	S1	S2	S3	S4
<u>DIMENSION</u>	<u>DIMENSION</u>	* <4	* <8	* <47	* <73
<u>PRONUNCIATION</u>	<u>PRONUNCIATION</u>	* <33	* <23	* <24	* <16
<u>CONDUCT</u>	<u>CONDUCT</u>	x >97	* >11	x >168	x >44
<u>DEPENDENCE</u>	<u>DEPENDENCE</u>	x >44	x >55	x >65	x >37
<u>CONVERSELY</u>	<u>CONVERSELY</u>	x <30	x >57	x >18	-
<u>CATASTROPHIC</u>	<u>CATASTROPHIC</u>	* >15	* >20	* >6	* <21
<u>ACCOUNT</u>	<u>ACCOUNT</u>	x >100	x >73	x >114	x >119
<u>AVALANCHE</u>	<u>ADEQUATE</u>	* >27	* >11	* <25	* <6
<u>TECHNICIAN</u>	<u>SIGNIFICANT</u>	x >40	x >27	x >54	* <1
<u>FANTASIA</u>	<u>GUSTATION</u>	x >141	* >46	x >69	x >23
<u>PENTAMETER</u>	<u>MENTALITY</u>	* >6	* >24	* >13	* >15
<u>COMMUNICATION</u>	<u>SPECIFICATION</u>	* >52	* >4	* >20	* <10
<u>SENTIMENT</u>	<u>SENDING</u>	x >18	* <3	x >58	x >22
<u>MORTIFICATION</u>	<u>VERSIFICATION</u>	* >35	* >15	* >17	* <25
<u>VARIABILITY</u>	<u>IMPERCEPTIBILITY</u>	x >38	x >52	x >31	x >16
<u>SICILY</u>	<u>CONSIDERED</u>	x >139	x >3	x >37	x >17

Table Kviii: Margins of durational difference between accented syllables in one-word utterances and their counterparts in longer utterances (*, x and underlining are used as in Table Ki)

not been substantiated phonetically and therefore we must regard it as phonologically irrelevant.

Our discussion, so far, has been based on syllable-to-syllable comparisons. Now, we try to find out if there are any patterns for durational variations through word-to-word comparisons. A target word in a longer utterance has three possibilities with regard to durational variations it undergoes as compared to its token in the word domain.

These possibilities are as follows:

1. All the syllables of the long utterance token are shorter than their counterparts in the word-domain token. This pattern, in turn, branches out into three possibilities as follows:

i. All the syllables of the long utterance token are shorter by margins of difference that are all below the JND (e.g. SPENDING by S4, see Histogram 3 in Figure Kix below)

ii. Some syllables of the long utterance token are shorter by margins of difference that are above the JND, others by margins that are below the JND (e.g. UNDERWEAR by S2, see Histogram 1 in Figure Kix)

iii. All syllables of the long utterance token are shorter by margins of difference that are above the JND (e.g. MOUTHORGAN by S3, see Histogram 2)

As a whole, pattern 1 will be from now on referred to as "shorter one-way variations" for the sake of brevity.

2 All the syllables of the long utterance token are longer than their counterparts in the word domain. This pattern will be referred to from now on as "longer one-way variations". It constitutes, in turn, three possibilities as follows:

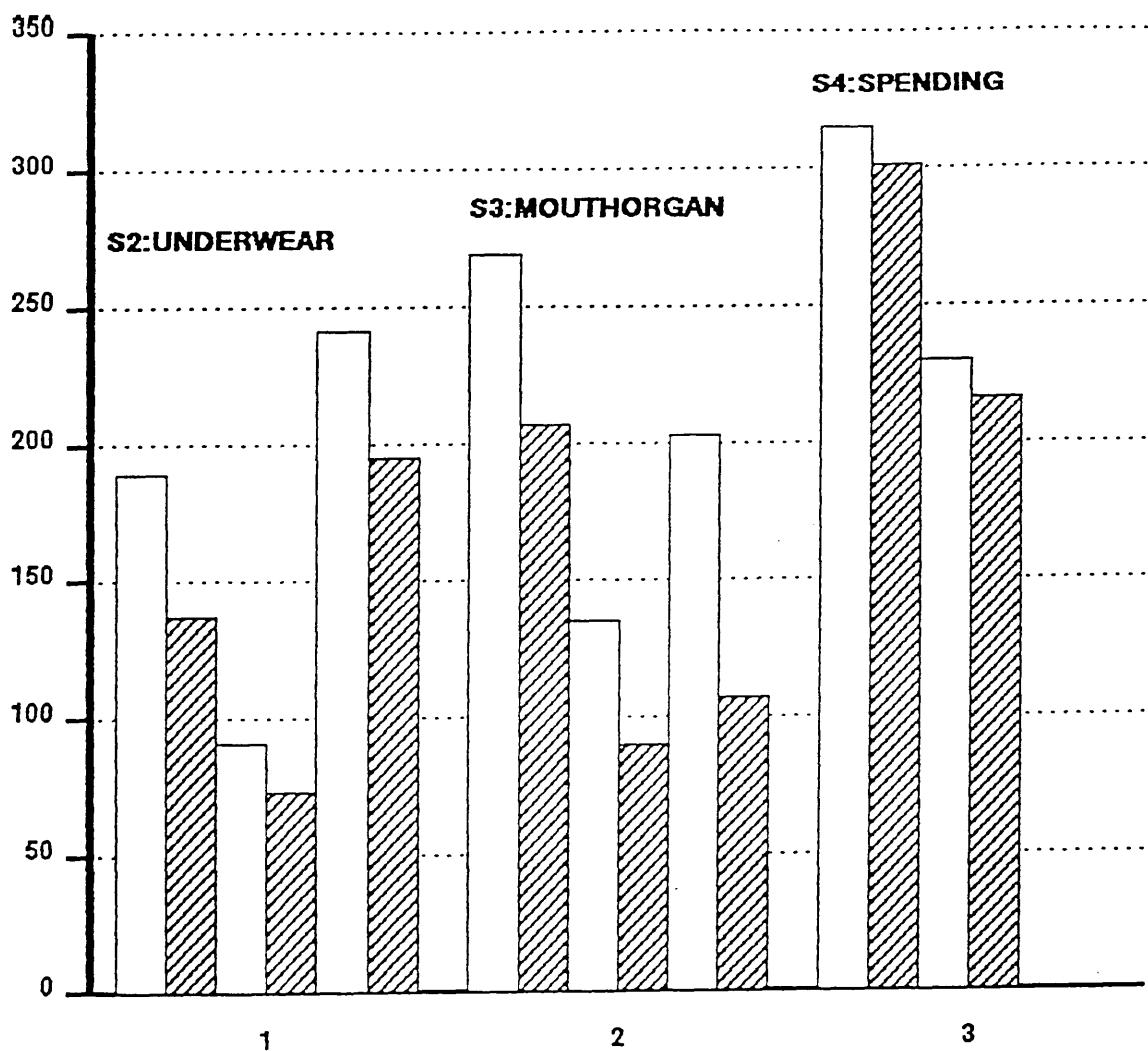


Figure Kix: Examples of typical durational variations in msec of syllables in one-word and longer utterance tokens of words (continued below).

- Syllable-duration in the one-word utterance token.
- Syllable-duration in the long utterance token.

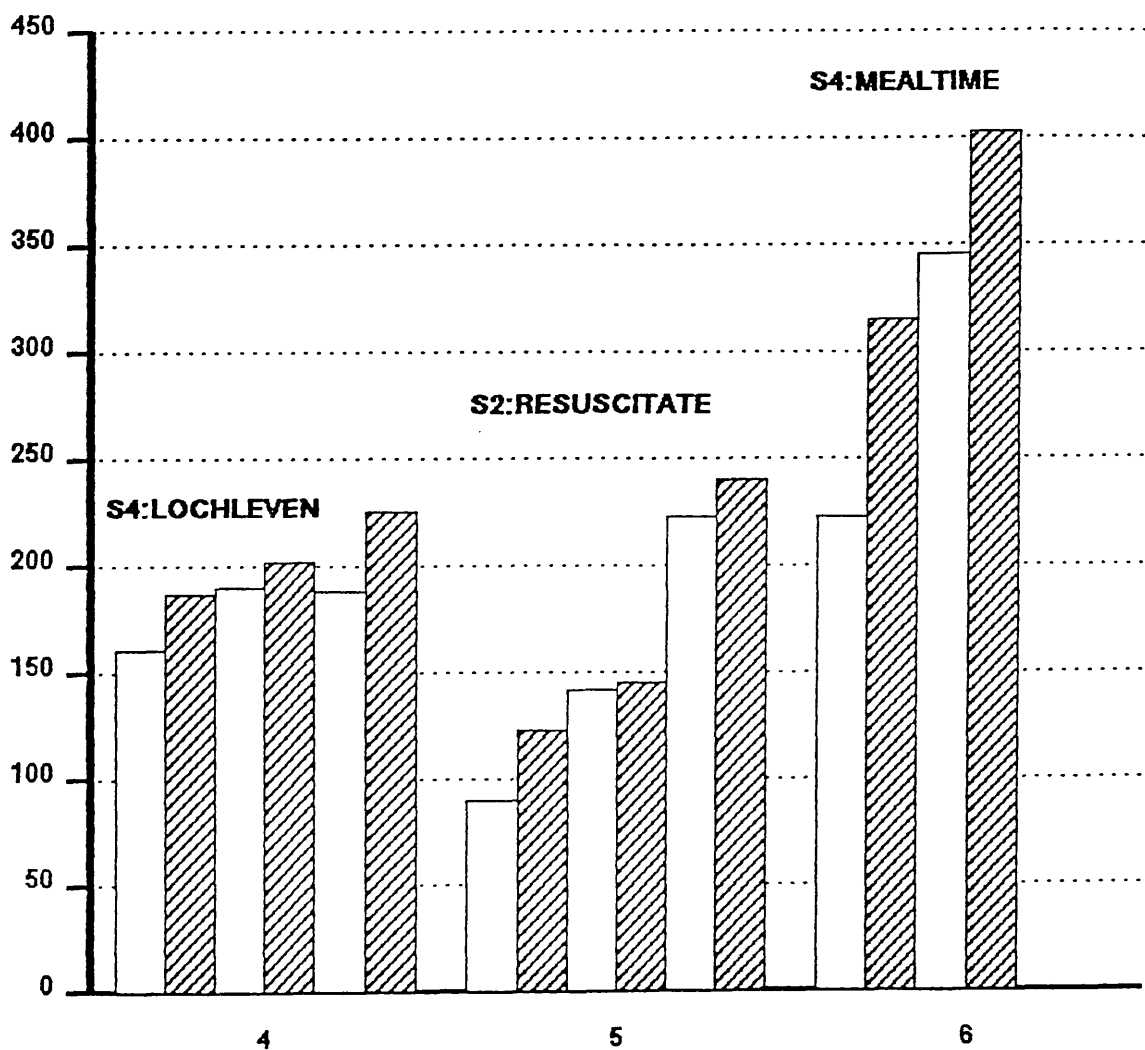


Figure Kix: (Continued from above).

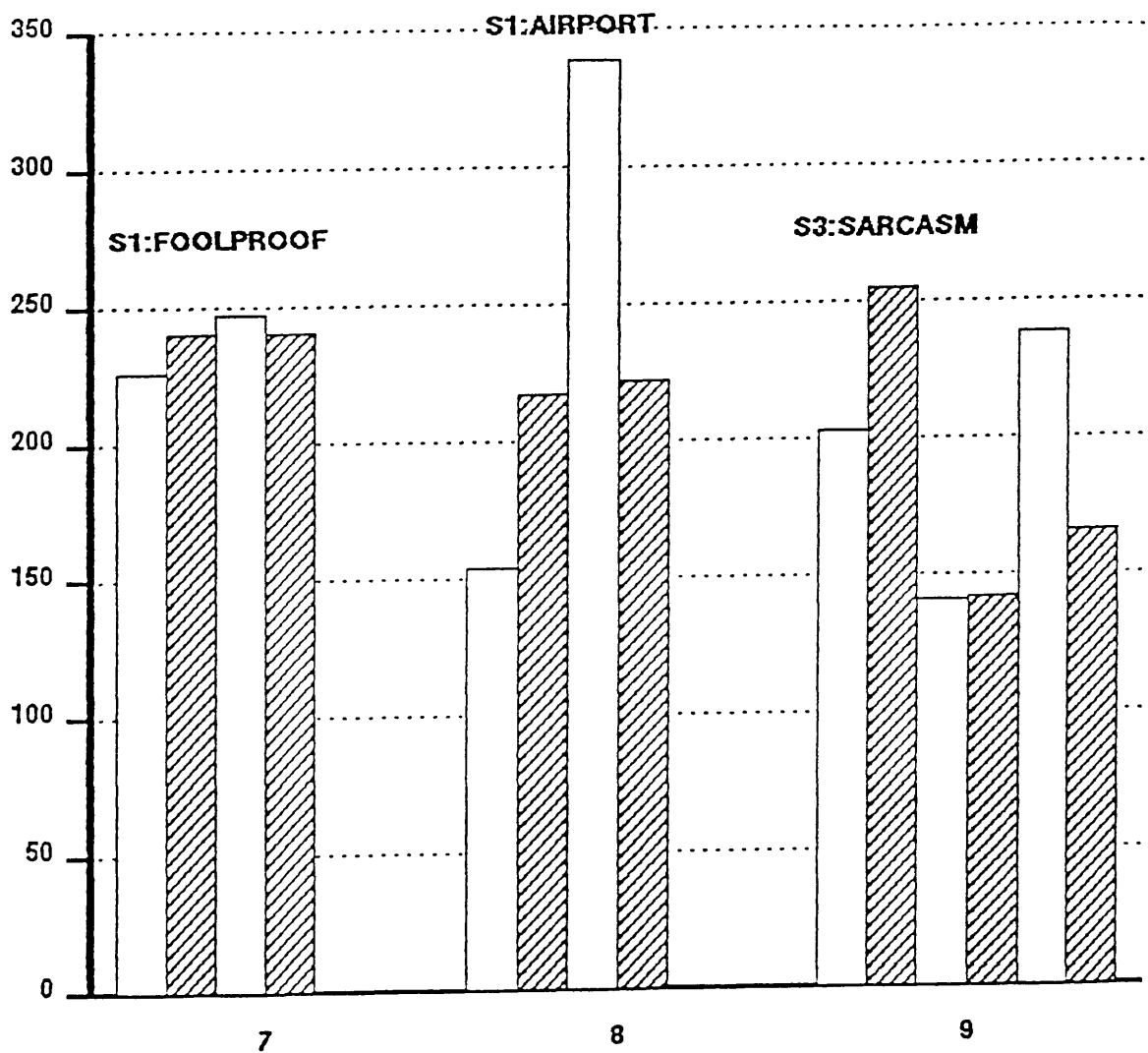


Figure Kix: (Continued from above).

i. All syllables are longer by margins of difference that are below the JND (e.g. LOCHLEVEN by S4, see Histogram 4)

ii. Some syllables are longer by margins that are above the JND, others by margins that are below the JND (e.g. RESUSCITATE by S2, see Histogram 5)

iii. Some syllables are longer by margins that are above the JND; others by margins that are below the JND (e.g. RESUSCITATE by S2, see Histogram 5)

3 Some syllables of the longer utterance token are shorter than their counterparts in the word domain, and others are longer. For the sake of brevity this pattern will be referred to from now on as "two-way variations".

There are as well three possibilities for this pattern of variation:

i. Two-way variations with margins of difference that are below the JND (e.g. FOOLPROOF by S1, see Histogram 7)

ii. Two-way variations with margins that are above the JND (e.g. AIRPORT by S1, see Histogram 8)

iii. Some variations are over the JND, and others are below the JND (e.g. SARCASM by S3, see Histogram 9).

Table Kx below gives a word-to-word comparison. Where shorter one-way variations occur, the total margin of difference is given preceded by the > sign. Where longer one-way variations occur, the total margin is given preceded by the < sign and underlined. Where two-way variations occur, the corresponding slot is divided into two: one for the total of the > variations and the other for that of the < ones. In this third case when one of the two totals or both are below the JND, the slot is marked by ".", and when both are over the JND, it is marked by "x".

Word	S1	S2	S3	S4
UNDERSTANDABLE	>138	>23 <48 [.]	>93 <28 [.]	>97 <58 ^x
ELECTROCHEMISTRY	>83 <72 ^x	>78 <92 ^x	>170 <26 [.]	>157 <64 ^x
FULFIL	>69	>145	>225	>83
MISUNDERSTAND	>261 <20 [.]	>180	>31 <57	>22 [.] <37 [.]
LONDON	>190	>71 <29 [.]	>179	>60 <12 [.]
FILTRATION	>127	>115 <1 [.]	>61 <6 [.]	>199
STAND UP	>84	<60	>156	>64 <45 ^x
VERSIFICATION	>217 <9 [.]	>34 <49 [.]	>127 <98 ^x	>166 <19 [.]
MACHINEGUN	>179	>47 <11 [.]	<67	>120 <126 ^x
MENTALITY	>161 <16 [.]	>112 <11 [.]	>46 <21 [.]	>39 <52 [.]
SENDING	>158	>173	>205	>170
WHEREBY	>287	>138	>176	>86 <2 [.]
RESUSCITATE	>152	<94	>95	>41 <15 [.]
UNDERWEAR	>115	>116	>20 <6 [.]	>51 <32 [.]
LOCHLEVEN	>64 <42 ^x	>40 <4 [.]	>46 <156 ^x	<75
MENTAL	>187	>127	>175	>167
AIRPORT	>117 <63 ^x	<54	>122 <57 ^x	>177
HARMFUL	>143	>126	>14 <1 [.]	>86

Word	S1		S2		S3		S4	
MEALTIME	>29	<20	<u><40</u>		>50		<u><149</u>	
SPECIFY	>94	<43 ^x	>23	<21 [.]	>162		>65	
SPENDING	>359		>142		>135		>28	
RETURN	>184		>277		>225		>168	
SARCASTIC	>188	<30 [.]	>65	<51 ^x	>120	<29 [.]	>90	<6 [.]
SPECIFICATION(S)	>31	<129 [.]	>6	<46 [.]	>56	<29 [.]	>54	<2 [.]
ARTIST	>184		>165		>151		>137	
LANDLORD	>133		>64	<12 [.]	>155		>167	
FUNDAMENT(S)	>61		<u><89</u>		<u><87</u>		>25	<124 [.]
SARCASM	>85		>91		>72	<53 ^x	>45	<69 ^x
AVALANCHE	>214		>68	<11 [.]	>214	<61 ^x	>108	<48 [.]
ARCHITECT	>117		>126	<70 ^x	>108	<31 [.]	>31	<36 [.]
RUMPTITUM	>89	<27 [.]	>113		>27	<99 [.]	>25	<53 [.]
MILTONIC	>145	<69 ^x	>61	<47 ^x	>65	<21 [.]	>11	<3 [.]
MENDING	-		>171		>128		>214	
STANDSTILL	>122		>45		>62	<20 [.]	>18	<3 [.]
MOUTHORGAN	>171	<15 [.]	>120	<56 ^x	>203		>67	<3 [.]
NEWTONIAN	>214		>14	<52 [.]	>86		>42	

Word	S1		S2		S3		S4
FUNDAMENTAL(S)	>50	<48 ^x	>37	<68 [.]	>15	<174 [.]	>143
RUMBUSTIOUS	>101	<4 [.]	>144	<22 [.]	>204	<8 [.]	>102 <29 [.]
MILLIONAIRESS	>48	<60 ^x	>95	<90 ^x	>103	<27 [.]	>271 <2 [.]
ORGAN	>231		>47	<12 [.]	>126		>31
LENDING	>157		>31	<19	>104		>134
AUGUST	>124	<13 [.]	>52		>100	<42 ^x	<u><37</u>
HOT-POT	>76		<u><262</u>		>44	<33 [.]	>14 <30 [.]
FOOL-PROOF	>7	<14 [.]	>176		>56	<5 [.]	<21
NON-STOP	>55		>55		>83	<56 ^x	>24 <5 [.]
STAND UP	>109	<12 [.]	>29		>135		>114
MISUNDERSTAND	>197		<u><82</u>		<u><32</u>		<u><139</u>
MISUNDERSTAND	>105	<24 [.]	<u><192</u>		>27	<87 [.]	>9 <115 [.]
STAND UP	>174		>65		>116	<52 ^x	>61
MENDING	-		>176		>153		>165

Based on Table Kix, numbers of instances of the various patterns of durational variations in word-to-word comparisons are given in Table Kxi below.

CASE	S1	S2	S3	S4	TOTAL
Shorter one-way variations	28	20	18	17	83
Longer one-way variations	-	8	3	4	15
Two-way variations: > or < variations or both below JND	12	15	18	21	66
Two-way variations: > or < variations both over JND	7	6	8	5	26

Table Kxi: Numbers of instances of the various patterns of durational variations in word-to-word comparisons of long utterance tokens to one-word utterance tokens.

The preceding two Tables are interpreted as follows:

I. We ascribe one-way variations whether shorter or longer mostly to a change in speech-rate. The word "mostly" is used in this respect to indicate that a change in tempo to a faster rate in the sentence domain may coincide with the incidental tendency of a given syllable to be shorter than its counterpart in the word domain because of either of the two reasons of considerable syllable shortening described in our discussion of the syllable-to-syllable comparison earlier in this Test. In this specific case, though, it is expected that the margin of difference for that given syllable should be far shorter than the other syllables in the same word. See, for instance, the margins for the syllables of the following

words in Table Ki above:

FUNDAMENTS (S1), RETURN (all informants), WHEREBY (S1,S3), UNDERWEAR (S2), FILTRATION (S1), SPECIFY (S3), SARCASM (S2), NEWTONIAN (S1) etc. It should be added, however, that this is a tendency that we infer from averages rather than from individual cases of comparison.

One-way variations both longer and shorter make 98 cases of comparison in all, that is to say 51% of the total number of cases of comparison. This percentage then is the first to be dismissed as a chunk of cases whose variation cannot be attributed to the presumed effect of a change of the level of utterance (i.e. from the word to sentence domain), if such a distinction can be regarded as relevant.

II. Two-way variations can be considered, in this respect, in three different classes:

i. > and < variations that are below the JND. These represent 12 out of the 178 cases of comparison. A sentence domain token undergoing this sort of variation is simply as close to the word domain token as another one-word utterance could be.

ii. Two-way variations where the totals of the > or < variations are below the JND. We assume that this sort of variation is close to the one-way variations discussed in I above. This class of variation applies to 56 cases of comparison. Adding the numbers of the (i) and (ii) cases to the (I) one, the percentage amounts to 86% approximately.

iii. Two-way variations where the < and > total margins of difference are over the JND. These are classifiable into three types:

(1) Those that show > and < variations that are only over the JND as totals. Individual syllables undergoing the > or < variations or

both are below the JND (e.g. VERSIFICATION by S2, SPECIFICATIONS by S3). This type makes 7 out of the 26 cases included in (iii).

Being negligible in individual syllables, this type of variation is not, of course, one we should be looking for in order to support the dissociation of so-called sentence-accent and word-accent.

(2) Those that undergo considerable (i.e. within the threshold of perception) > and < variations represented by single syllables where the syllable that undergoes the considerable shortening is a word-final syllable (e.g. LOCHLEVEN by S3, ARCHITECT by S2, AIRPORT by S1, SARCASM by S3 etc). Variations that this type of word undergo cannot be ascribed to a change of the level of utterance since word-final syllables have been found to have a strong tendency to be shorter in the utterance domain. Cases of this type constitute 10 out of the 24 in (iii). Adding the 17 cases of this type and the preceding one, the percentage that have to be dismissed rises to 96% of all cases of comparison.

(3) Those that show > and < variations represented by single syllables where the former type of variation is not represented by a word-final syllable (e.g. ELECTROCHEMISTRY by S1, MOUTHORGAN by S2 etc). This type consists of 9 cases (i.e. 4% approximately of the data of the Test). If the variations of this type were to be attributable to a change of the accent level from word-accent to sentence-accent, they obviously make too small a percentage to render any hypothesis plausible.

To conclude, we assumed when we started to discuss the results of this Test that:

i. if the durational variations that words undergo in the sentence domain as compared to their tokens in the word domain are

considerable and if they are not attributable to any factor other than the occurrence in the sentence domain, then the phonological distinction of word-and sentence-accent and the related concept of "the word in citation form" will be valid ones.

ii. if, on the other hand, the variations are not considerable, or if they are considerable and attributable to factors that do not function exclusively in the sentence domain then that distinction and the related concept are not plausible.

Results of this Test have been considered in two ways:

I. Syllable-to-syllable comparison which shows that:

i. Variations are either insignificant, or

ii. when they are significant they are due to:

(1) a change from primary tonic accent to primary non-tonic accent.

The latter type is not exclusive to long utterances, neither obviously is the former.

(2) The fact that word-final syllables are always pre-pausal in the word domain and are often not so in the sentence domain. This factor of syllable-position is known to function in the word domain as well.

II Word-to-word comparisons: It has been found that only 4% approximately of the cases of comparison show considerable two-way variations (i.e. that cannot be ascribed to a change of speech-rate or to any other explanation). Even if such a percentage of cases were to be due to a change in the level of accent from word-accent to sentence-accent, it is obviously not considerable enough to render the assumption for such a change a substantial one.

Thus, on the basis of duration, the phonological distinction of word-accent and sentence-accent is not plausible and neither is the

related concept of the word in citation form.

Test L

Average Durations of Syllables with Different Degrees of accent in a Corpus of Long Utterances.

A relatively big corpus of long utterances (fifty in all) was selected as the data for this Test. Lexicographically speaking (i.e. according to the potential syllabification based on the EPD's recorded pronunciation) this corpus included 939 syllables for each informant. A certain number of syllables had to be removed from our calculations for the following reasons:

i. Syllable elision which accounted for most of the syllables removed. In the word TEMPORARY, for instance, the syllable #P0#, or rather its vocalic nucleus, was elided by the four informants. So was the next syllable in the same word by S2. We should indicate here that where syllable elision took place, initial consonants were included in the measurement with the preceding or with the following syllables as would prove adequate according to an informant's own pronunciation

e.g. - TEMP#~~RA~~#RY (the /p/ is included in the preceding syllable to exemplify the former case).

- CHA#RAC#TRIS#TIC#LY (the /t/ is included in the following syllable, to exemplify the latter case).

ii. Syllables the duration of which could not have been determined fully by means of the spectrograph. Syllables of this type had for their initial segments a plosive or a low-amplitude fricative while they occurred at the beginning of a sentence:

e.g. CHEMISTRY AND ELECTROCHEMISTRY BOOKS...

or immediately after an utterance-medial pause:

e.g. SOCIAL UPHEAVALS//DON'T AUGUR...

After such eliminations, the numbers of the syllables included in the calculations were as follows:

S1	926
S2	925
S3	932
S4	928

Syllables removed from the calculations are marked in Appendix L by a dash in the corresponding slot.

The aim of the Test was two-fold:

- To attempt to establish reliable durational averages for the syllables with different types of accent. As the averages we obtained through specific Tests dealing with one type of accent or another with the constraint of identity in syntagmatic and paradigmatic structure were derived from limited numbers of syllables, we decided to include this Test where we can talk of thousands rather than tens of syllables.
- To establish the role of duration in distinguishing the syllables with different types of accent. In other words: does duration alone suffice to distinguish each and every type of accent from the one/s up or down the accentual hierarchy, or is it only effective in distinguishing between certain types and not so between others?

Before referring to the methods adopted in the Test and to the results, it is more appropriate to make some segmental, accentual, and intonational remarks about the characteristics of the data analysed in this Test.

1 There is one single noteworthy case where the pronunciation of

two informants (S1 and S2) does not conform segmentally to the pronunciation recorded in the EPD. Instead of the EPD's CABMAN /kæbmən/ , the two informants say /kæbmən/. The two tokens of the second syllable were therefore included in what we called secondary-like category of syllables (described further below).

2 i. There are cases peculiar to S3 where the informant deviates from the EPD's accentual pattern of some words. PROGRESS is uttered /prəv`gres/ rather than /\`prəvgres/ and RUMPTITUM is uttered /\`rʌmtɪtʌm/ rather than /\`rʌmtɪ`tʌm/. Syllables of those words were classified into the different types of accent according to the actual pronunciation given by the informant, not according to the EPD's.

ii. There are other cases where syllables marked with secondary accent in the EPD receive primary accents in the data on account of contrast. #IN# in INDIRECT is given primary accent by informants S1, S2 and S4. #MAL# in MALNOURISHED is given primary accent by S1 and S4.

3 One of the striking aspects from the point of view of intonation that tended to characterize the pronunciation of all four informants, when "reading aloud" ("Reading Aloud" being one of the speech styles (cf. Brown et al. 1980: 141) was that they often resorted to what might be described as "pulsative uttering" of one chunk of speech after another within a given sentence. That is, instead of having one tonic per breath-group (as intonation textbooks e.g. O'Connor and Arnold (1973) would indicate) there were many cases where there was more than one.

In their attempt to refine the notion of the tonic, Brown et al

state that: "In pause-defined units there may be several foci, marked as contrastive/emphatic or new by the speaker" (1980: 160). The pulsativeness referred to here does not spring from the information structure or any other semantic justification for tonicity but is rather superimposed upon them as a repetitive pattern of delivery.

This pulsativeness is clear, for instance, from the way S2 utters the phrase: REGULAR PENTAMETER RHYTHM. Hence the three syllables #REG#, #TA# and #RHY# are all classified as tonics. Due to this pulsativeness, S3 gives four tonics out of five primary accents in the sentence:

"SPORTS COMPETITIONS // HAD AT FIRST // A RELIGIOUS ORIENTATION//.

In the sentence:

THEIR SOCIALISM WAS A COMBINATION OF NATIONALISM AND REPUBLICANISM, three out of the four lexicographical primary accents are uttered as tonics by all the four informants. Figure Lpc gives some intonation contour displays of typical examples of this feature.

We can see how far this pulsativeness is frequent in the data of this Test, if not throughout all the sentences of the whole study, when we realize that the number of tonic syllables in this Test is 601, just 25 syllables short of the number of primary non-tonic accents. As the sentences for the Test were mostly long sentences, one would expect - at least judging by the rules of intonation textbooks - that the tonics would only form a small fraction in number compared to the primary non-tonics.

We turn now to the methods through which the syllables in this corpus of sentences were classified into the different types of accent.

INTONATION-CONTOUR-DISPLAY

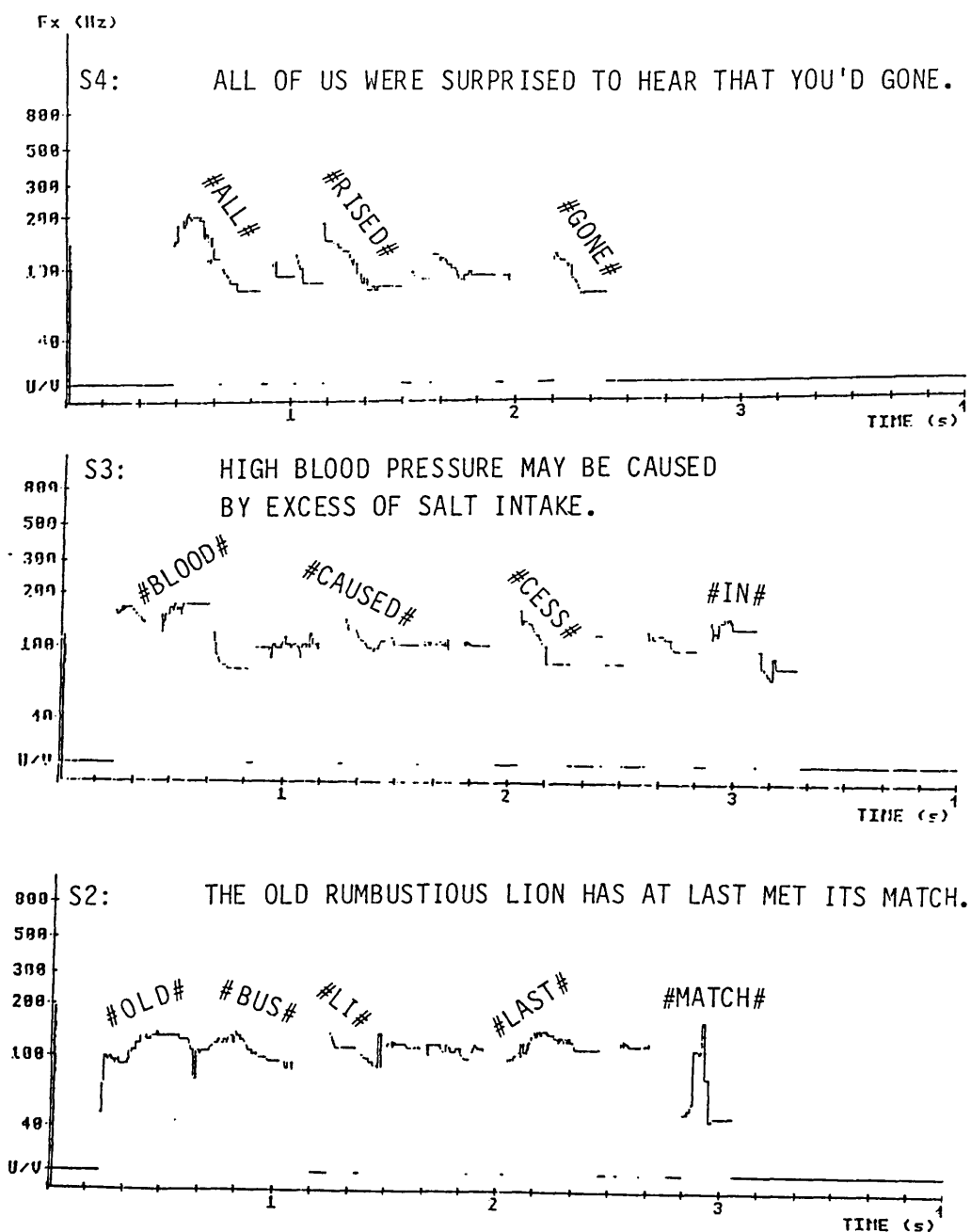


Figure Lpc: Intonation contour displays of typical examples of pulsative delivery of long utterances.

- Syllables receiving primary accents in the EPD in polysyllabic words were assigned primary non-tonic accents (marked by x in Appendix L). Monosyllables were judged according to their relative prominence in the actual utterance of each informant. Those primary accents that were judged as receiving pitch prominence (on account of corresponding pitch change or pitch height) were classified as tonics. (Tonics are marked by * in Appendix L). Exceptions due to misaccenting are referred to above.

- Syllables receiving secondary accents in the EPD were also classified as secondary accents here (marked by ^ in Appendix L). EPD unaccented syllables that we think had been left out in the EPD due to possible inconsistency were included in a separate category which we called "syllables with secondary-like accent" (see below for examples). Syllables of this category can be subdivided into two groups as follows:

i. Monosyllables like NOT, YOU, I, WHO, WILL, WAS etc which did not have sentence accents, yet at the same time had full vowel quality (marked by . in Appendix L).

ii. Syllables in polysyllabic words that had full vowel quality inter-phonemically and/or intra-phonemically (i.e. their vocalic nuclei were anything other than /ɪ/, /ʊ/, or /ə/). In cases where they were /ɪ/ or /ʊ/ they were not centralized vowels.

Examples of this group are the underlined syllables in the following words: UPHEAVALS, WELFARE, EXPECTATIONS, MISUNDERSTAND, ALREADY, FILTRATION, MACHINE-GUNS, MENTALITY, WHEREBY, PORTRAIT/- trext /, LOCHLEVEN etc. (Syllables of this group are marked in Appendix L by "?").

Syllables marked by either "." or "?" were kept apart as far as

marking is concerned so that calculations of the averages might be carried out twice; once according to the EPD's classification, and once according to the classification we propose in this study.

The EPD-marked secondary accents together with the two other types of syllables we regard as receiving secondary accents exhibited variations in duration. These average variations are shown in Figure Li for each individual informant apart and for the four of them collectively. Monosyllables (marked with ".") are on average 9 msec below the average for the EPD-marked secondary accents; but the group marked "?" average a durational difference that is, compared to either of the two other types, quite above the threshold of perception. There is in fact no apparent reason for the durational variations among these groups of syllables.

- The remaining syllables, after excluding those marked by "." and those marked by "?", are the ones we regard as actually unaccented. These are marked in Appendix L by "~".

The results of the Test are represented by histograms in Figures Lii, Liii, Liv, Lv and Lvi. The variables under investigation in the Test are each represented by a column. Where our classification differs from that of the EPD (i.e. in the case of syllables with secondary accent and that of unaccented syllables) we give an alternative dotted column. The third column from the left in all the figures represents the average for the syllables with the two types of primary accent (i.e. primary tonic and primary non-tonic) jointly.

The four Figures representing the averages for individual informants show that there are durational differences among the

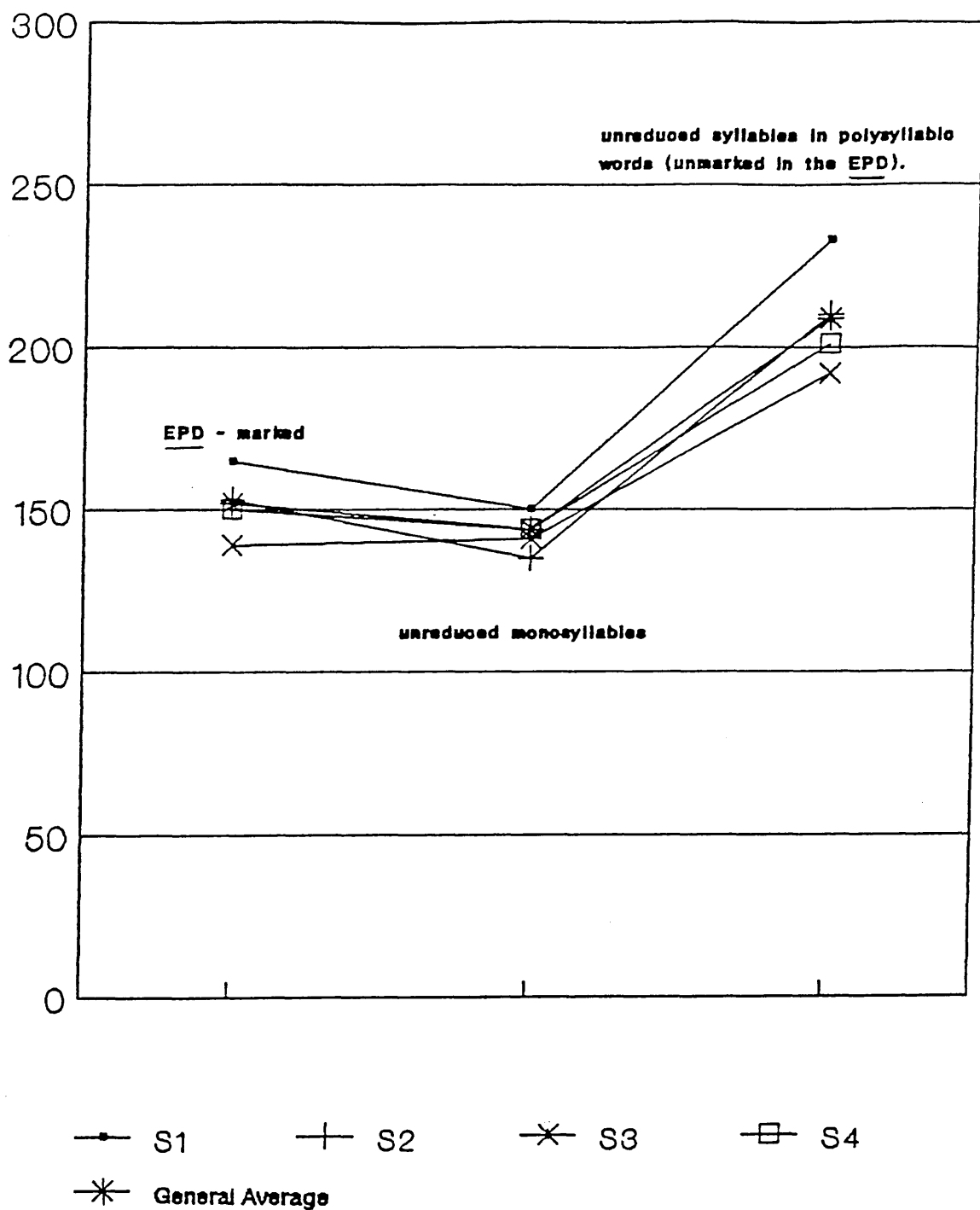


Figure Li: Average duration in msec of three types of syllables with secondary accent (according to our proposed classification) for the four informants individually and collectively.

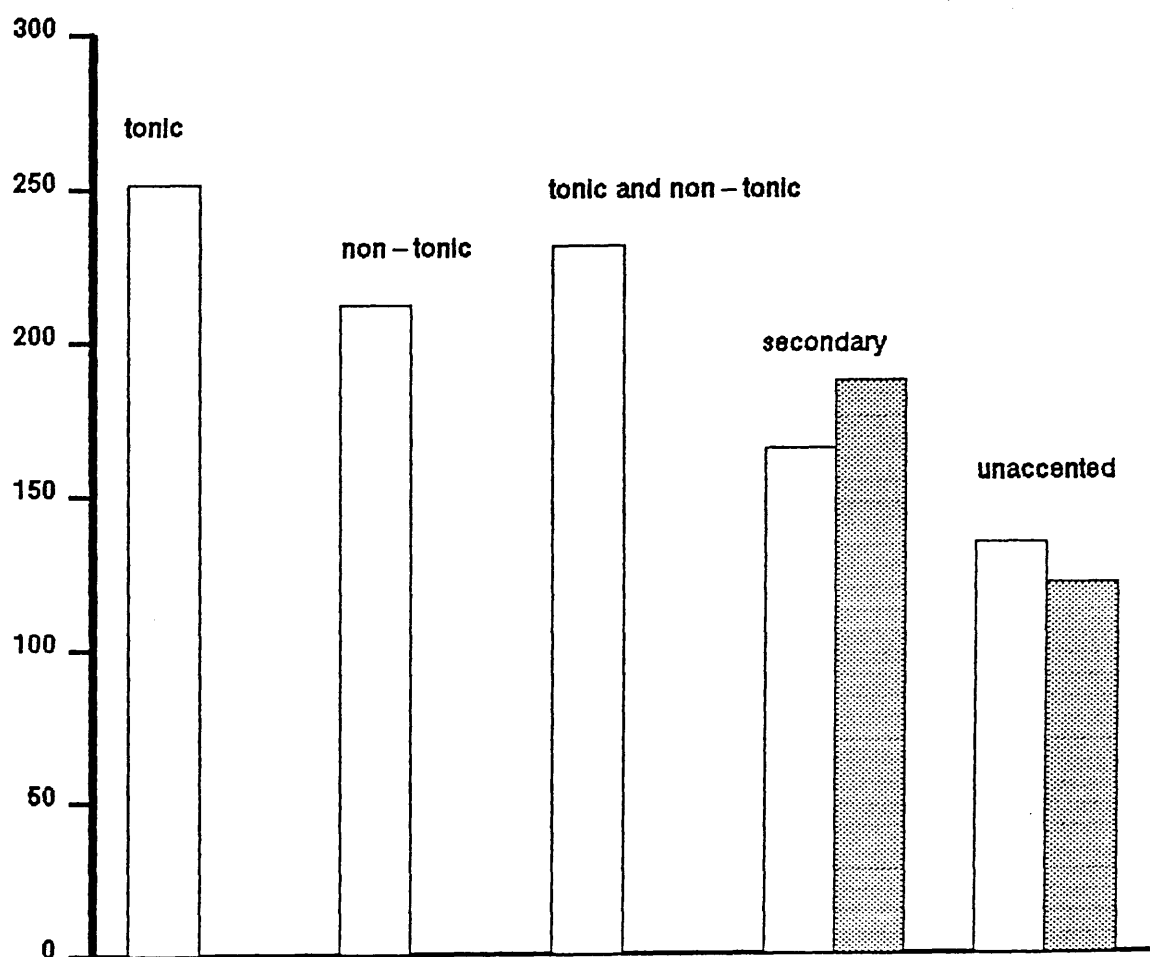




Figure Lii: Average duration in msec of syllables with different types of accent for S1.

 Average according to the EPD classification
 Average according to our proposed classification

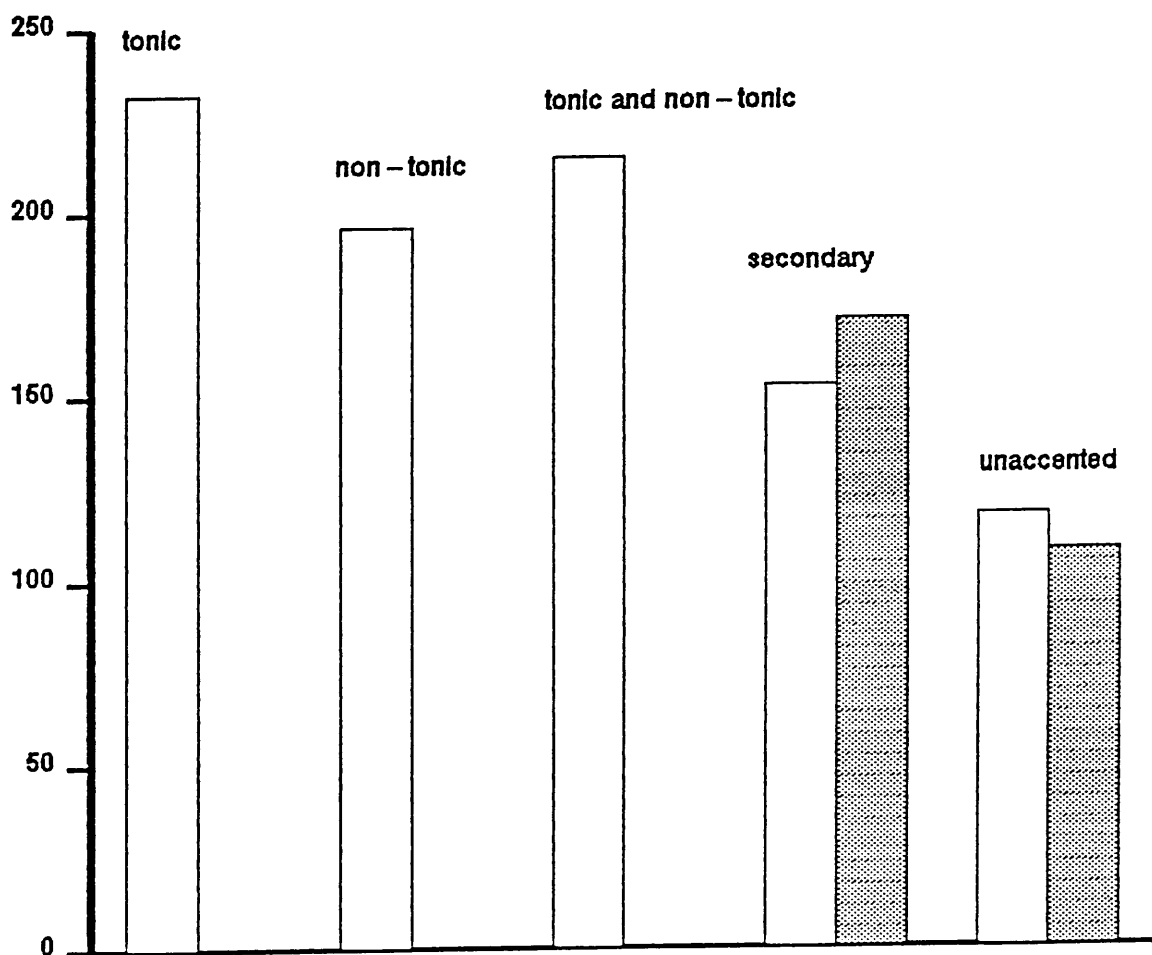
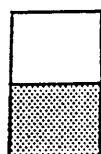


Figure Liii: Average duration in msec of syllables with different types of accent for S2.



Average according to the EPD classification

Average according to our proposed classification

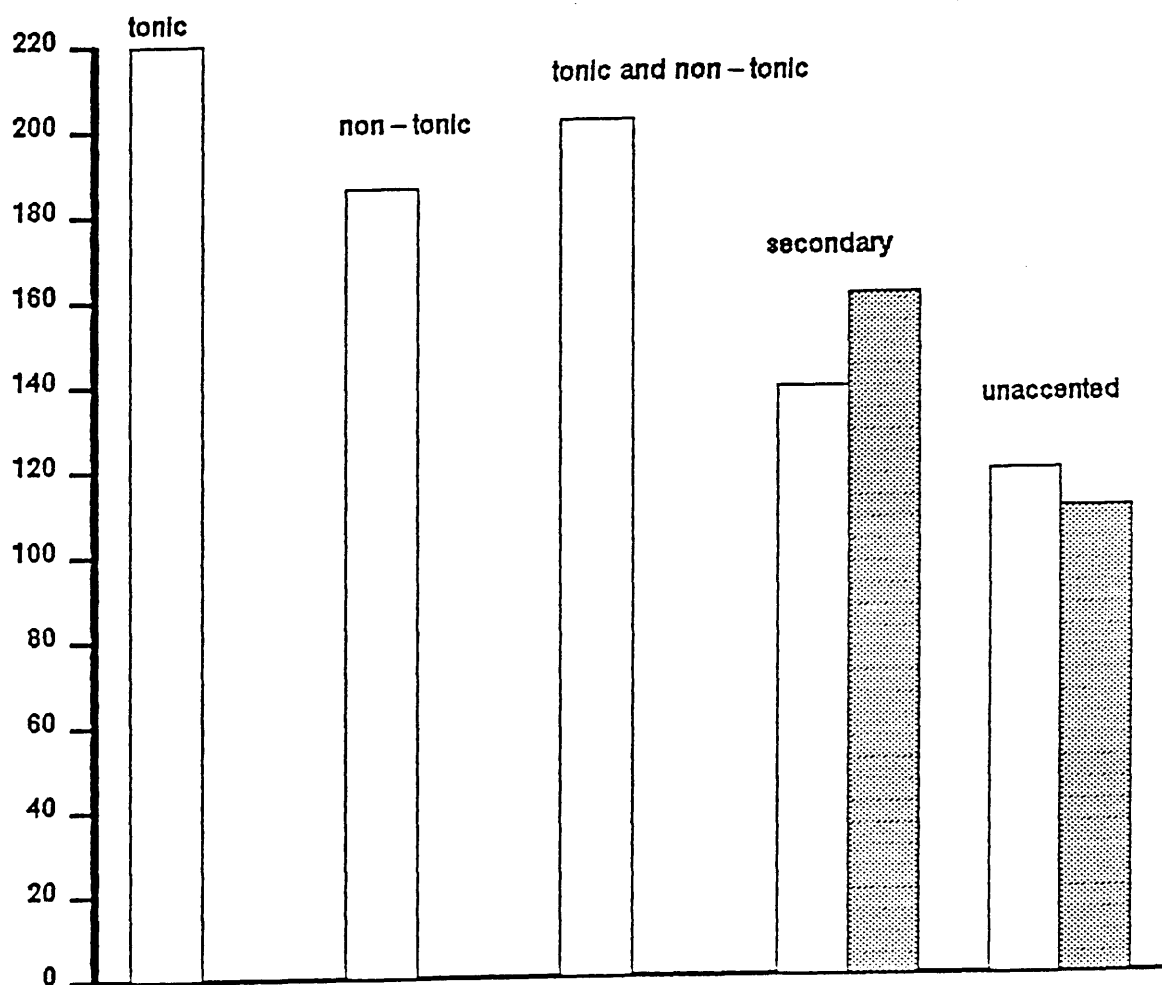


Figure Liv: Average duration in msec of syllables with different types of accent for S3.



Average according to the EPD classification

Average according to our proposed classification

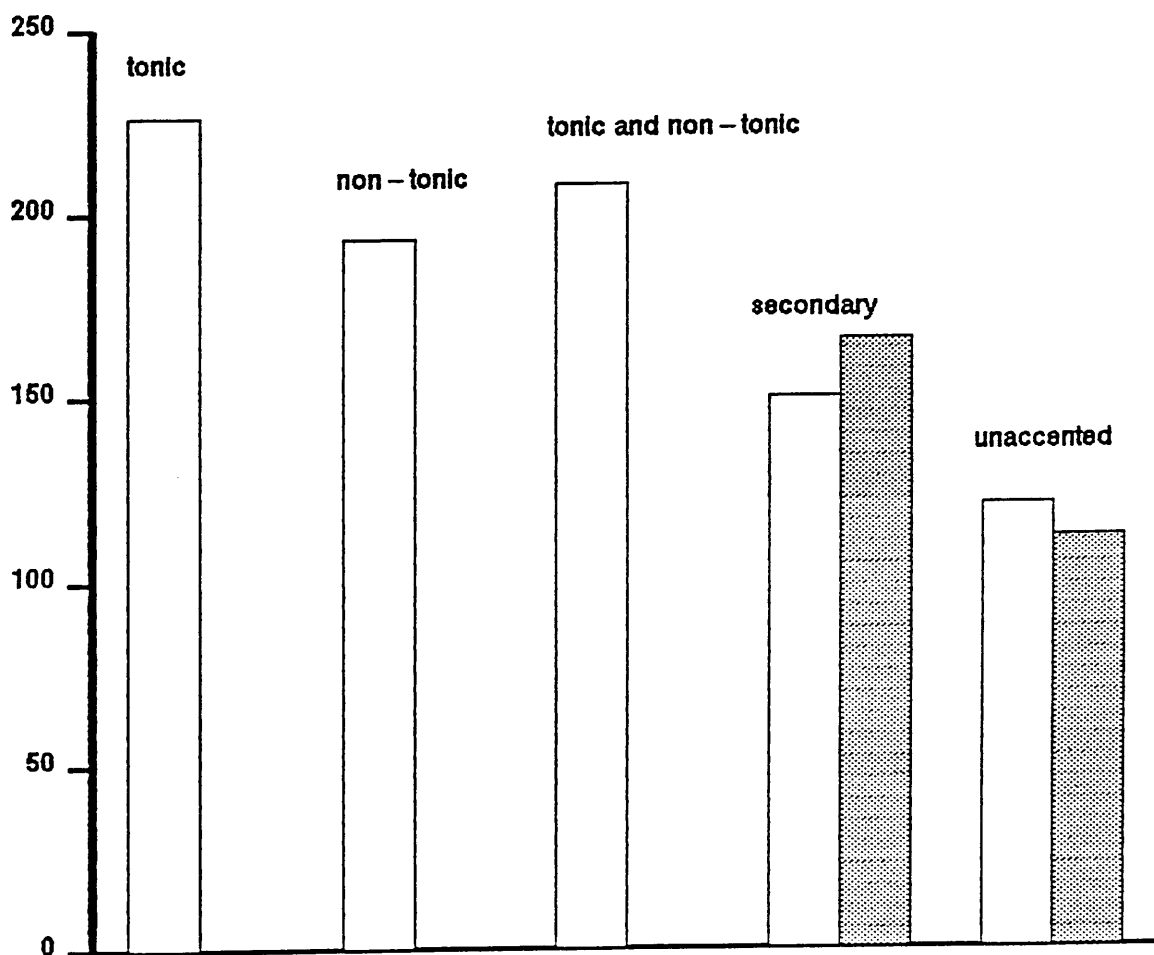


Figure Lv: Average duration in msec of syllables with different types of accent for S4.



Average according to the EPD classification

Average according to our proposed classification

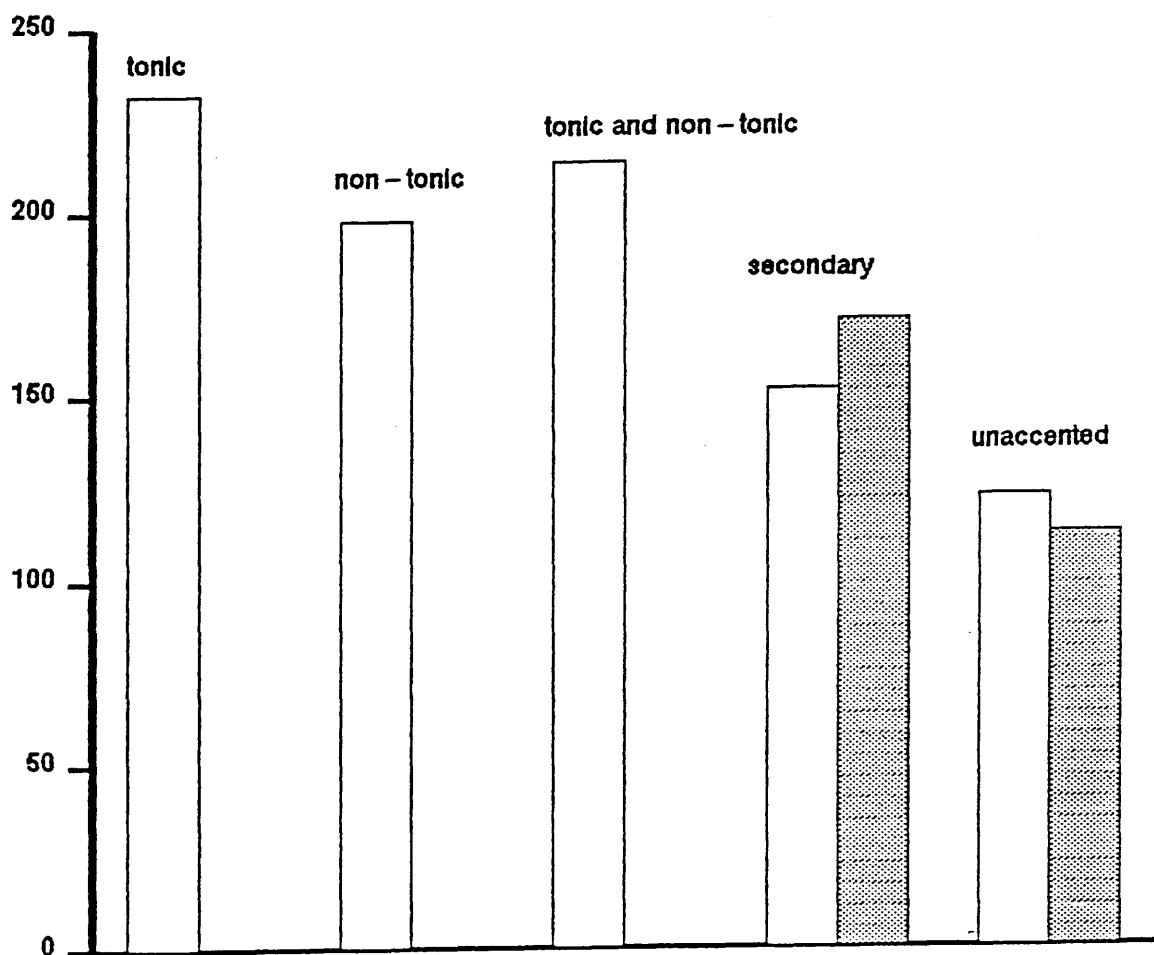


Figure Lvi: Average duration in msec of syllables with different types of accent for the four informants collectively.



Average according to the EPD classification

Average according to our proposed classification

averages for corresponding variables from one informant to another. These differences however are all well below the perception threshold. According to the magnitude of the averages for corresponding variables, with the one exception of unaccented syllables, S1 comes first as having greater durational averages for the different types of syllables, S2 second, S4 third and S3 fourth. The few cases where the consistency of the informants is slightly broken is in the area of unaccented syllables where S4 shows greater values over S3 and the latter in turn over S2.

The inter-variable differences can be summarized as follows:

1. Tonic and non-tonic primary accents: The differences between these two types for individual informants range from 33 msec in the case of S4 to 39 msec in the case of S4 averaging 34 msec in favour of the primary tonics. Thus the tonics are on average consistently longer than the primary non-tonics but the margins of difference are either just or slightly below the perception threshold. This result, then, does not lend enough support to a potential hypothesis in this respect that tonics are markedly longer than the primary non-tonics. The consistency of all the informants in keeping a margin of difference in favour of the tonics is an indication in that direction.

If the JND is insisted upon as the dividing line between significant and insignificant margins of difference, this result can be interpreted as supporting Bolinger's suggestion (1958a) that duration is "residual" to pitch, that is to say that duration is a by-product of pitch prominence, be it pitch change or pitch height. There is no reason at this point to assume that Bolinger's suggestion is valid in any context wider than the comparison between

tonics and primary non-tonics. Indeed when that suggestion was made, it was part of Bolinger's theory that accent was but pitch, and other parameters, if any, were there only dependently.

2. Unaccented syllables and syllables with secondary accent:

According to the EPD's classification these two categories show no significant margins of durational difference. The average margins of difference range from 35 msec in the case of S2 to 20 msec in the case of S3 averaging 29 msec for the informants collectively. These margins of difference are all in favour of syllables with secondary accent, but in terms of magnitude, the difference is well below the perception threshold. According to the EPD's classification, therefore, duration does not represent a good correlate that can distinguish these two types of accent.

This result is probably not surprising when we find that in the sentence:

"LOCHNAGAR AND LOCHLEVEN ARE BOTH SCOTTISH PLACE NAMES", the #LOCH# in LOCHNAGAR (averaging 216 by the informants) is marked in the EPD as a secondary accent, while the token of the same syllable in LOCHLEVEN (averaging 236 msec) is left out as an unaccented syllable. Again, one cannot understand why #DOG# in UNDERDOG is marked as a receiving secondary accent, while #TIME# in MEALTIME is not.

To avoid these and similar possible inconsistencies, we decided to include all syllables with full vowels intra-phonemically (i.e. considering the various allophones of a single phoneme) and/or inter-phonemically (i.e. comparing the phonemes with one another) in our classification as syllables with secondary accent. We regarded as unaccented syllables the EPD's unaccented syllables that had for

their nuclei schwas, syllabic consonants, or [ʊ] or [ɤ].

According to our proposed classification, the margin of difference between these two types of syllable ranges from 66 msec in the case of S1 to 51 msec in the case of S3 averaging 58 msec for the informants collectively. Thus the margins of durational difference between these two types of accent in the case of both the individual informants and the general average are well within the perception threshold. As far as duration alone is concerned, this result confirms that unaccented syllables and syllables with secondary accent as specified in our proposed classification are two distinct categories of syllables.

The following is a list of typical examples of words whose accentual patterns, we suggest, would need to be reconsidered in the light of the classification proposed here. The underlined syllables in the orthographic version of the words are those which would need to be marked as receiving secondary accents. Some of the words listed below have other variants (the transcription of which is not included here) that are in perfect accordance with the accentual patterns assigned them in the EPD. Our argument applies only to the variants transcribed here.

AFTER <u>THOUGHT</u>	/`ɑ: ftəθɔ: t/
<u>ALCHEMIC</u>	/æ l`kemɪk/
<u>ALLOCATE</u>	/`æləʊkɛrt/
AND <u>ANTINO</u>	/ændænti:nəv/
<u>ANORAK</u>	/`ænərək/
BALLET- <u>GIRL</u>	/`bæ lɪgɜ: l/
<u>BARBARIC</u>	/bɑ: `bærɪk/
BED <u>SPREAD</u>	/`bedspred/

<u>BOMBARDMENT</u>	/bɒm\ bɑ: dmənt/
<u>CALCUTTA</u>	/kæl\ kʌtə/
<u>CANDLE-LIGHT</u>	/ˈkændllart/
<u>CARAVAN</u>	/ˈkærəvæn/
<u>CONTEM PLATIVE</u>	/ˈkɒntemplɛɪtɪv/
<u>DEMONETIZATION</u>	/di: ˌmʌnɪtaɪˈzeɪʃn/
<u>DETRUNCATION</u>	/ˌdi: trʌŋˈkeɪʃn/
<u>DUFFLE-COAT</u>	/ˈdʌflkəʊt/
<u>DUNFERMLINE</u>	/dʌn\ fɜ: mlɪn/
<u>DUPLICATE</u>	/ˈdju: plɪkɛɪt/
<u>EGG-SHAPED</u>	/ˈegʃeɪpt/
<u>ELABORATE</u>	/ɪˈlæbəreɪt/
<u>EXTRADOS</u>	/eks\ treɪdɒs/
<u>FANFARONADE</u>	/ˌfænfərəˈnɑ: d/
<u>FANTASIA</u>	/fænˈteɪzjə/
<u>FEEDING-CUP</u>	/ˈfi: dɪŋkʌp/
<u>FLACCIDITY</u>	/flæk\ sɪdɪtɪ/
<u>FORECAST</u>	/ˈfɔ: kɑ: st/
<u>GLADSTONIAN</u>	/glæd\ stəʊnjən/
<u>GOLDMINE</u>	/ˈgəʊldmaɪn/
<u>GOURMET</u>	/ˈgʊməɪ/
<u>HABITAT</u>	/ˈhæbɪtæt/
<u>HAIRSTROKE</u>	/ˈheəstrəʊk/
<u>HANDFUL</u>	/ˈhændfʊl/
<u>HENDECAGON</u>	/hen\ dekəɡən/
<u>HIERARCHY</u>	/ˈhaɪərə: kɪ/
<u>ICELANDIC</u>	/aɪs\ lændɪk/
<u>INCANTATION</u>	/ˌɪŋkænˈteɪʃn

INTELLECT	/ˈɪntələkt/
IRONMOULD	/ˈaɪənməʊld/
JOHNSONIAN	/dʒɒnˈsəʊnjən/
JUGGERNAUT	/ˈdʒʌgənɔː vt/
JUGFUL	/ˈdʒʌɡfʊl/
JUSTIFIABLE	/ˈdʒʌstɪfaɪəbl/
KAMPALA	/kæmˈpɑːlə/
KINESTHETIC	/ˌkaɪniːsˈθetɪk/
KNIFEBOARD	/ˈnaɪfbɔːd/
KNOCKABOUT	/ˈnɒkəbaʊt/
LABOURITE	/ˈleɪbəraɪt/
LADEFOGED	/ˈlædɪfəʊɡɪd/
LAMBASTE	/læmˈberst/
LAMPLIGHT	/ˈlæmplaɪt/
MAGNIFICAT	/mægˈnɪfɪkət/
MALAPROPISM	/ˈmæləprɒpɪzəm/
MALODORANT	/mælˈəʊdərənt/
MASTERPIECE	/ˈmaːstəpiːs/
NEPTUNIUM	/nepˈtjuːnjəm/
NERVE-CELL	/ˈnɜːvsel/
NO-MAN'S-LAND	/ˈnəʊmənzlænd/
NOMINATE	/ˈnɒmɪneɪt/
OCTOBER	/ɒkˈtəʊbə/
ORGANIZATION	/ˌɔːɡənəɪˈzeɪʃn/
ORNAMENTATION	/ˌɔːnəmentəɪʃn/
OUTCASTE	/ˈaʊtkɑːst/
OXIDIZE	/ˈɒksɪdaɪz/
PANDEMIC	/pænˈdemɪk/

PAPER <u>BACK</u>	/ˈpeɪpəbæk/
<u>PARTICIPATION</u>	/pɑː ˈtɪsɪˈpeɪʃn/
PHANTASMAGORIC	/ˈfæntəzməˈɡɒrɪk/
<u>PICTOGRAPH</u>	/ˈpɪktəɡrɑːf/
QUANTIFY	/ˈkwɒntɪfaɪ/
QUESTION-MARK	/ˈkwestʃənmaːk/
QUINCENTENARY	/ˈkwɪnsentiːnəri/
<u>QUINTILLION</u>	/kwɪnˈtɪljən/
<u>RABBI</u>	/ˈræbaɪ/
READING- <u>DESK</u>	/ˈriːdɪŋdesk/
<u>RECTANGULAR</u>	/rekˈtæŋɡjələ/
SACRIFICE	/ˈsækrɪfaɪs/
SALT <u>SPOON</u>	/ˈsɔːltspuːn/
<u>SARDINE</u>	/sɑːˈdiːn/
SENTIMENTALIZATION	/ˈsentɪmentəlaɪzɪʃn/
<u>TECHNOLOGIST</u>	/tekˈnɒlədʒɪst/
<u>TELEGRAPH</u>	/ˈtelɪɡrɑːf/
TOILET- <u>SET</u>	/ˈtɔɪlɪtset/
TRANSCENDENTAL	/ˈtrænsenˈdentl/
<u>UKRAINE</u>	/juːˈkreɪn/
UNCLASSIFIABLE	/ˈʌnˈklæsɪfaɪəbl/
UNDERESTIMATE	/ˈʌndəˈestɪmeɪt/
UTTERMOST	/ˈʌtəməʊst/
VALENTINE	/ˈvæləntaɪn/
<u>VALHALLA</u>	/vælˈhælə/
VEGETATIVE	/ˈvedʒɪteɪtɪv/
VINICULTURE	/ˈvɪnɪkʌltʃə/
VOWEL- <u>LIKE</u>	/ˈvəʊəllaɪk/

WALL <u>WORK</u>	/ˈwɔ: lwɜ: k/
WANAM <u>AKER</u>	/ˈwɒnəmerkə/
WATER <u>GATE</u>	/ˈwɔ: təgert/
WHERE <u>ABOUTS</u>	/ˈweərəbaʊts/
<u>WHEREVER</u>	/weərˈevə/
<u>XANTHIPPE</u>	/zænˈθɪpɪ/
XYLO <u>PHONE</u>	/ˈzaɪləfəʊn/
YARD <u>ARM</u>	/ˈjɑ: dɑ: m/
<u>YELLOW-BAND</u>	/ˈjeləʊbænd/
<u>YSTRADGYNLAIS</u>	/ˌɪstrədˈɡɪnlais/
<u>ZAMBEZI</u>	/zæmˈbi: zɪ/
<u>ZINCO GRAPH</u>	/ˈzɪŋkəʊgrɑ: f/

3 Syllables with primary non-tonic accent and those with secondary accent: According to the EPD's classification, syllables with secondary accent show average margins of durational difference that range from 47 msec in the case of S1 and S3 to 43 msec in the case of S2 and S4 making a general average difference of 46 msec in favour of the syllables with primary non-tonic accent. These margins of difference are, thus, above the perception threshold both individually and collectively.

Calculated according to our own classification, however, the individual and general averages for syllables with secondary accent are greater, thus reducing the margins of difference referred to above to a general average of 27 msec.

Speaking as we did in Test I above, about syllables with primary accents both tonics and non-tonics as one category, significant margins of difference are found in favour of syllables

with primary accent. The third column from the left in the five Figures of averages above represents the tonics and primary non-tonics together. The average difference is 43 msec.

The problem remains: why are there no significant margins of difference between syllables with secondary accents (according to our proposed classification) and syllables with primary non-tonic accent? It might be said that vowels with full quality like those forming the nuclei for syllables with secondary accents, in the proposed classification, are ones that would not allow for much lengthening, being already of full quality. This explanation is certainly not a plausible one for:

- if it were plausible the margin of difference between the syllables with primary non-tonic accent and the EPD-marked secondary accents, themselves of full quality vocalic nuclei, would not be above the threshold of perception.
- Again if it were plausible there would not be that considerable variation in the duration of the three types of syllables we regard as having secondary accents, as shown in Figure Li above.

To sum up the results of this Test:

- 1 Duration does not seem to be the only parameter that distinguishes the two types of primary accents (tonics and non-tonics) if the JND is insisted upon as the dividing line between significant and insignificant margins of durational difference. There are consistent margins of difference in favour of the former type but they are either just or slightly below the JND.
- 2 The classification of syllables according to the perceptual and/or phonemic fullness and weakness of vowel quality into unaccented syllables and syllables with secondary accents has solved

the problem of the lack of appropriate margins of difference between those two types of syllables if the EPD classification is adopted.

3 According to the proposed classification, the margin of difference between syllables with secondary accent and syllables with primary non-tonic accent is below the threshold of perception. This is a problem for which there seems to be no apparent explanation. An appropriate margin of difference, however, exists when the comparison is made between secondary accents and the two types of primary accents jointly rather than the non-tonic alone.

Conclusions of Chapter III

The conclusions of this Chapter on a Test-by-Test basis are as follows:

1. Test CU. Comparisons of syllable durations in this Test have shown that syllables with primary accent are on average longer than syllables with secondary accent. The average margin of difference is 42 msec. Another result of the Test is that there is evidence of the inconsistency of the EPD marking of the secondary accent since syllables with primary accent have been found to be on average longer by only 40 msec than a given category of EPD unaccented syllables. We have called this category "syllables with secondary-like accent".
2. Test DU. Comparisons in this Test have shown that, as hypothesized, syllables with primary accent are longer than their unaccented counterparts. Two margins of difference could be distinguished: 64 msec in favour of syllables with primary tonic accent, and 51 msec in favour of syllables with primary non-tonic accent.

3. Test EU. In this Test, syllable-position as the location of a given syllable before or after the word tonic syllable did not affect the duration of unaccented syllables significantly. Syllable position has proved an effective factor where post-tonic syllables are themselves word-final ones. Syllables with these specifications have been found to be on average 59 msec longer than pre-tonic word-initial syllables.

4. Test H. We attempted in this Test to find out whether there could be significant margins of difference in terms of syllable duration between appositional phrases on the one hand and the sentences containing them on the other. If such margins were to exist, this would suggest that the prominence of appositional phrases is achieved by means of a change in speech-rate either by way of increase or by way of decrease. Syllables in appositional phrases were found to be on average longer than their non-appositional counterparts but the margins of difference were found not to be big enough to give full support to this explanation. However, the fact that all informants were consistent in keeping an average margin of difference between syllables in appositional phrases on the one hand and non-appositional parts on the other is an indication in that direction. Similarly, pausing was found to offer only a partial explanation for the prominence of appositional phrases since it did not occur at all boundaries of appositional phrases, and the durations of pauses were not uniformly within the JND.

5. Test I. In this Test, accented syllables have been found to maintain their durational advantage over syllables with secondary accent; and the latter, in turn, over unaccented syllables. No

evidence has been found to suggest that the durational compression resulting from the increase in speech-rate is done mostly at the expense of unaccented syllables. The average margins of durational difference among the syllables with these types of accent have been found to be more balanced when the syllables we regard as receiving secondary-like accent are classified with the syllables marked with secondary accent in the EPD.

6. Test J. In this Test syllable duration was found to be a consistent parameter of "extra-strong accent"; a type of accent under which is subsumed what is commonly known as "contrastive accent". Syllables which received a shifted accent were found to be on average 80 msec longer than where they were unaccented. This is a big margin of difference in view of the fact that syllables normally accented were longer than their unaccented counterparts by only 49 msec (Test D).

7. Test K. In this Test, the distinction between so-called word-accent and sentence-accent has been found to be implausible in at least so far as duration alone is concerned.

Syllable-to-Syllable comparisons of words in one-word utterances on the one hand and of longer utterances on the other have shown that durational variations are either insignificant or, when considerable, are attributable to factors other than the change of the one-word to the longer utterance domain or vice versa. Besides, word-to-word comparisons have shown that considerable two-way variations (i.e. that some syllables in the one-word token are jointly considerably longer than their counterparts, and the rest are jointly considerably shorter) form too small a percentage to support an assumed change in the level of accent from word-accent to

sentence accent.

8. Test L. In this Test an attempt was made to find out whether there are significant margins of durational difference among the different types of accent in a corpus of fifty sentences.

Consistent margins of difference were found to exist between tonic and non-tonic accent but these did not amount to the JND. Thus duration alone (if the JND is insisted upon as the sole dividing line between significant and insignificant margins) does not distinguish tonic and non-tonic primary accents. Allotting the syllables judged as having secondary-like accents to syllables with EPD secondary accent solved the problem of the lack of significant margins of difference between syllables with secondary accent on the one hand and unaccented syllables on the other if the EPD classification was to be adopted. Significant margins of difference existed between syllables with secondary accent and syllables with primary accent only where both categories of the latter type were lumped together but not when syllables with non-tonic accent were considered alone.

CHAPTER IV
ACCENT AND PERCEPTION

Introduction

This chapter is divided into two parts:

Part 1. An extended literature review:

In this part we aim at reviewing the major hypotheses tested and theories and models put forward with regard to the relation between accent and perception.

Part 2. A perception test:

In this part, we describe a perceptual experiment that we carried out to test further hypotheses in this respect and to shed some light on the hypotheses and theories reviewed in part 1.

It is relevant, first of all, to repeat that accent as considered in this study is the syllable-based phenomenon that gives a polysyllabic word, whether in a one-word or a longer utterance, its pattern of prominence. Some of the studies referred to in this chapter adopt a different view of accent, namely accent as the one, or occasionally more than one, syllable that is most prominent in a long utterance. Accent in this latter view is regarded by us as a type subsumable under our broader concept of accent. This is why no further indication will be made where studies reported adopt it. Besides, some of the studies referred to in this Chapter may not deal exclusively with English - indeed some are restricted to individual languages other than English. In this case, reference to such studies will be made in so far as they report results or make assumptions that may be appropriately considered relevant for the study of English.

Part 1: The Literature Review

The review below will consider the relation of accent to perception under two headings:

- (i) The way accent itself is perceived. This section is concerned with the intrinsic nature of accented versus unaccented syllables, and it deals mainly with the physical properties of accented syllables and the theories that explain the way accent is perceived.
- (ii) The effect of accent on the perception of connected speech. This section is concerned with the effect of the patterning of accented and unaccented syllables on the identification of words as part of the task of sentence perception, and the recognition of the semantic structure and the rhythmic nature of speech.

(i) The way accent itself is perceived:

The advantage accented syllables have over unaccented syllables in terms of perceptibility seems to be too obvious and hence to have received little attention in the field of empirical research. This situation, however, is due to another reason besides the fact that such an advantage is taken for granted. Accent is part of the implicit knowledge of the native user of the language. Unlike being able to identify the <s>s in an utterance, accent is not something the user can locate without being given at least an indication of its nature, as, for instance, being instructed to identify the parts of an utterance that stand out from the rest.

In short, accent is not, in English at least, a distinctive

feature. In fact, experiments on the acoustic correlates of perceived accent with synthetic speech data, like those of Fry (1955, 1958, 1965) and Bolinger (1958a), were designed on the basis of that very presupposition of the greater perceptual prominence of the accented syllables over the unaccented ones.

Different interpretations have been offered to account for the perceptual prominence of accented syllables. Goldstein (1977) assumes that speech recognition involves two mechanisms: a time window mechanism for making incomplete judgements about the acoustic signal (i.e. one that functions piecemeal as the utterance proceeds) and a decision-making mechanism that determines which word has been perceived. The latter mechanism relies not just on the input of the former but also on the phonological, syntactic and semantic context and expectations arising from the listener's implicit knowledge of the language. In other words, perception is an ongoing process in which the time-window offers preliminary hypotheses that are continually modified until final decisions are favoured and stuck to by the decision-making mechanism. Accented syllables are, in the light of the assumption referred to above, perceptually more prominent than unaccented syllables for two reasons:

1. They do not involve as much constraining to the time-window mechanism since they are less phonetically ambiguous (i.e. being generally longer, higher in amplitude and highlighted by pitch change).
2. They receive relatively more attention during perception. In an experiment on varying beep-to-accent distance (i.e. where a beep is superimposed on an utterance), Shayne and Gass (1976) found that the

longer the distance, the fewer the correct responses and vice versa where the beep is designated as the target. A similar result has been reached by Cutler and Foss (1977) who found that the reaction-time to a word-initial phoneme was shorter when it occurred in an accented syllable than when it occurred in an unaccented one.

The question of accented syllables exercising a pull on the attention during perception (as indicated in the second reason) seems to us to be more appropriate as an effect rather than as a cause of the perceptual prominence of accented syllables. Effects of the perceptual prominence of accented syllables are discussed in (ii) below. The first reason clearly indicates the role the physical properties of the speech signal play in rendering accented syllables perceptually prominent.

The fact that these physical properties activate the earlier mechanism (i.e. the time-window one) indicates the primacy of their role in the perception of accent. There is evidence to suggest that this primacy is in terms of time rather than importance; the physical properties of the speech signal assist earlier in the process of perception but the outcome is not imposed solely by them.

Janota and Palkova (1974) investigated the role of context versus that of the physical parameters in the auditory evaluation of accent. Target Czech words containing the syllable /se/ which is of high frequency in that language were judged once in a five-page story context, and once individually after words had been excised from that story. Significant correlation between the physical parameters of duration, intensity and frequency and the perception of accent was found to exist in the latter case only.

Some apparently contradictory evidence of the role of the

physical parameters of the speech signal is reported by Lackner and Tuller (1976). Presenting their listeners with a continuously repeated string of monosyllabic words, they found that perceptual re-grouping gave rise to strings different from the original one, with "dramatic changes in apparent stress and intonation despite the fact that the physical signal never varied" (1976: 306). It is doubtful that the physical properties of speech are discarded as they seem to be in such continuously repeated strings. The investigators do not indicate whether or not the original string had a particular intonation contour as a single utterance. The existence of an attitudinally and semantically specific contour would, one would expect, have discouraged different perceptual reorganisations. If the signal does not have such a contour, listeners are bound to perceptually impose one themselves in order to approximate the perceived sequence to the more "life-like" utterances they use. Again, if such a contour does not exist, listeners' imposition of syntactic and intonational boundaries is bound to be oriented by some semantic bias. The re-grouping of the string "the see i sun" into "ice on the sea" in that experiment is an example of this. Cooper and Fowler (1984) refute the claim that accent is a post-perceptual illusion, as implied in the Lackner-Tuller study, and show that perception of accent is sensitive even to the "subphonemic acoustic/articulatory properties of the initial consonant". Besides, Rosenvold (1981) finds that the F_0 and durational variations required to identify a vowel as being accented are different for close and open vowels.

Order of Importance of the Physical Parameters:

Several investigators have attempted to establish the order of importance of the physical parameters as cues to perceived accent (Mol and Uhlenbeck 1955; Fry 1955, 1958; Bolinger 1958a, 1958b; Lieberman 1960; Fry 1965; Morton and Jassem 1965; Fonagy 1966; McClean and Tiffany 1973; Lea 1977; Adams and Munro 1978; Bertinetto 1980; Beckman 1984, 1985, 1986). Some of these studies are concerned with the relevance of a single parameter to the perception of accent and some are concerned with languages other than English, or with specific varieties of English.

Different studies have reported different hierarchies for the physical parameters in this respect. In his study of synthesized minimal pairs like SUBJECT /^hsʌbdʒekt / vs/ səb^hdʒekt /, Fry (1955, 1958) found that duration outweighed intensity as a cue to accent perception, though the latter had a comparable effect. Changes in fundamental frequency outweighed both intensity and duration changes but they had an all-or-none effect. Bolinger (1958a/1965:17) summed up his theory of pitch accent in the following words: "...the prominence itself is an accent, whose major cue is pitch and whose auxiliary and residual cue is length and - to a minor (and hardly more than "voice-qualifying" or emotional) degree - intensity". Thus, Bolinger credited pitch not just with the most important role in accent perception but as the sole embodiment of accent.

Katwijk and Govaert (1967) found that pitch rises are more effective in achieving accentual prominence than pitch falls. Morton and Jassem (1965) confirmed Bolinger's results through their study of monomorphemic disyllabic words. In fact, one can say that

Bolinger's views (1958a) with regard to the production and perception of accent have found ready acceptance ever since. These views are reiterated in more recent studies (e.g. Bolinger 1986:21-22, 373; Cruttenden 1986:16-17; Jassem and Gibbon 1980; and Morton and Jassem 1965).

In a cross-linguistic study, Berinstein (1979) investigated the effect of duration on the perception of accent. She found that English listeners perceived longer syllables as accented as long as a durational advantage for a given syllable existed. In a sequence of syllables where such an advantage was lacking, they opted for the sequence-initial syllable as a location for accent. The latter finding was ascribed to the phonological bias of English to have the accent on the initial syllable. This bias has been found ineffective in perceiving sequences of non-speech signals (Bell 1977). Nooteboom (1972: 76), citing Liberman et al (1959) and Lisker et al (1962), maintains that durational variations were indispensable in simulating the effect of accent types in early experiments of synthesis-by-rule where the main concern was with intrinsic allophones and formant transitions. Bertinetto (1980) found, in another stress-accent language, namely Italian, that duration was the most effective cue of accent for Italian listeners, who listened to 64 tokens of the two accentual variants of synthesized words. Similarly, Nakatani and Aston (1978) had found that the word's durational pattern was more effective than pitch for the perception of its accentual pattern in the sentence. Isenberg and Gay (1978), manipulating the physical parameters of a synthetic monomorphemic disyllable, found that "linguistically sophisticated listeners were able to hear stable and reliable differences in

stress only when duration was manipulated".

Mol and Uhlenbeck (1955) found that increasing the amplitude of the first syllable of PER`MIT and decreasing that of the second syllable, and doing the opposite modifications in amplitude for the two syllables of `PERMIT did not affect the perception of the words as verb and noun respectively. They concluded from this result that intensity, both in the acoustic and articulatory sense, could not be relevant to the perception of accent. Moreover, Bolinger (1958b) found that raising the intensity of a low-intensity "pitch accent" did not improve the correct response of the listeners and the excessive increase of intensity even reduced the correct response.

Besides the physical properties of Fo duration and intensity there is also the effect of vowel quality, or physically speaking, the relation between the frequencies of F1 and F2 of the vocalic nuclei of syllables. The change in vowel quality in Fry's (1965) synthetic disyllabic words had a greater effect on the perception of accent in the first rather than the second syllable. Fry gave a tentative explanation of the fact that the effect of the change in vowel quality was dependent on syllable-position; that is, it could be an artifact of the vowel phonemes used in his stimuli. McClean and Tiffany (1973) found that, besides vowel quality, the effect of other physical parameters, too, was conditioned by syllable-position. Fo proved to be the most effective parameter in accenting the first syllable of "SASA" and duration took over in accenting the second syllable. In low-intensity speech, Fo and amplitude contrasts dropped considerably while duration became the predominant parameter of accent.

Perceptual Tolerance

It should be noted that accent perception does not function on the basis of having mirror images of the values of various physical parameters of the perceived utterances in the mind of the listener. Pierrehumbert (1979) reports that the relative prominence of accented syllables in neutral intonation is not copied by F_0 values. She further notes that in non-neutral intonation, accented syllables may be of lower F_0 values than unaccented syllables. Ladefoged and Broadbent (1957) report similar results for vowel quality. They find that listeners judge the quality of the vowels of given speakers not merely by the formant values of the vowels of target words but through the judgment of the formant frequencies of other vowels pronounced by the same speakers. Klatt and Cooper (1975) find that the same applies to vowel duration. Listeners are reported to adjust their expectations of vowel duration according to the position of the vowel in the word and in the longer utterance. This is to say that the listeners exercise perceptual tolerance in their perception of these physical dimensions.

Evidence Against Bolinger's Theory of Pitch Accent

Now we turn to Bolinger's (1958a) theory that accent is perceptually, as well as physiologically, signalled solely by pitch change. We indicated above that this theory of Bolinger's has been widely accepted in this respect.

Pieces of evidence undermining this theory have been sporadic until Beckman, in her 1984 thesis (published 1986 under the title: Stress and Non-Stress Accent), carried it a stage further.

Lieberman (1960) had found that intensity integral (i.e. the

integral of amplitude with respect to time over the duration of the entire syllable) ranked as good a correlate, indeed a slightly better one, to automatic accent detection in minimal pairs as Fo (92% vs 90% respectively). He concluded that "stress judgments are made on a multiplicity of simple decisions involving several cues". He also indicated that "certain trading effects offset a lack of differentiation in one acoustic dimension by changes, coherent with the perceptual stress pattern, in another dimension".

Some such evidence is provided by the study of various alaryngeal speech devices. Gandour et al (1982) find that patients using the Servox device, who did not have the facility of varying the Fo, failed to produce intonational contrasts to listeners (judged as doing so in 54% of cases only) but they managed to produce accentual contrasts (79.9%, 82.8%, and 81.9% for contrastive, lexical and syntactic accents respectively). Patients using the Western Electric device, who had that facility of varying the Fo, were better in marking the intonation (judged as doing so in 63.6% of cases), produced comparable percentages of perceived contrasts (82.4% and 81.3% for contrastive and lexical accent respectively) and excelled in marking syntactic accents (98%). They interpret the higher scores of the Servox users on contrastive, lexical and syntactic accents as compared to intonation and, we could add, the comparable percentages of accentual contrasts for both groups as "compatible with a multiparametric influence on stress perception". Cutler and Darwin (1981), in a phoneme-monitoring reaction time experiment, show that reduced reaction time (R.T.) to a word-initial phoneme as an effect of belonging to an accented rather than unaccented syllable is not

conditional on fundamental frequency variation. They argue accordingly that "variation along any prosodic dimension will prove sufficiently effective" for causing the R.T. advantage of accented syllables.

In a series of works, Beckman (1982, 1984, 1985, and 1986) studied the physical correlates of accent in Japanese (as an archetypal non-stress accent language) and in English (as an archetypal stress-accent language). In a perceptual experiment, she (1986: 179-199) presented three groups of listeners (Japanese, monolingual Americans, bilingual Americans) with synthetic stimuli based on representative non-artificial utterances. Her results can be summarized as follows:

- (i) Fo scored better in the Japanese stimuli and its scores were higher for the Japanese listeners than they were for the English listeners.
- (ii) Other parameters did not score better than the chance level (50%) in the Japanese stimuli, while in the case of the English stimuli, they scored relatively better, and the scores of the English listeners for these parameters were higher than those for the Japanese ones.

These results strongly discount Bolinger's (1958a/1965:17) theory that accent is embodied by "the ups and downs of pitch". Through comparing Japanese and English, apart from the comparison of the effects of the conventional parameters of Fo, duration, amplitude and spectra (i.e. quality), Beckman compares the effect of total amplitude (or intensity integral) with that of Fo. She finds that the former parameter overrides Fo in the perception of accent in the English stimuli by American monolinguals. Conversely, Fo

overrides total amplitude in the perception of accent in the Japanese stimuli by Japanese listeners. Whereas *F₀* significantly exceeds the chance level in the former case, total amplitude does not in the latter one. Beckman argues that since intensity integral has been found to be a more consistent correlate of accent in English than either duration or peak intensity alone in production tests in the same study (Beckman 1986), these two factors may not be independent of each other as perceptual correlates of accentual prominence. The effectiveness of this suggested correlate, she notes, should not be interpreted in terms of a trading relationship between two independent perceptual dimensions (i.e. loudness and subjective duration), but as a better criterion of loudness in itself (Beckman 1986: 196-197).

Fonagy (1966) accounts for the discrepancy among studies on the acoustic correlates of accent (cf. Fry 1955 and Mol and Uhlenbeck 1956); different sets of respiratory muscles may be occasionally predominantly more active than others, resulting in variations in the acoustic spectra of the accented syllables.

Besides, in synthetic stimuli, listeners are bound to identify the variable parameters rather than the ones that are kept constant as the only correlates of accentual prominence in that they approximate the effect of the accents in natural speech. In a brief review on the effect of manipulated acoustic parameters in relation to the perception of accent, Gay (1978) concludes that the perception of accent is related to a complex of acoustic features rather than to a single one.

Considering the physical correlates of accent in the wider context of linguistic perception, Taylor and Wales (1987) report

results which indicate that these correlates carry no intrinsic meaning in themselves as they belong to preattention processes, in parallelism with syntactic and semantic processing, acting as attention markers. This is in the line with the Goldstein (1977) model of speech recognition reported above, and differs only in that it would place the syntactic and semantic processes in what Goldstein calls the time-window mechanism.

Summary

This literature review on accent perception in relation to the physical parameters can be summed up as follows:

- (1) Accented syllables are more prominent than unaccented syllables partly because of their physical characteristics.
- (2) Crediting F_0 alone with accentual prominence in English does not account for the significant participation in the domains of production and perception of the duration and intensity parameters in English as compared to a non-stress accent language like Japanese. The consistency of the total amplitude parameter in this respect (Beckman 1986) is too considerable to be disregarded.
- (3) Apparent discrepancy among studies on the acoustic and perceptual correlates of accent may be due to the lack of constancy in the physiological mechanisms involved (Fonagy 1966) and the speech task carried out (McClellan and Tiffany 1973).
- (4) Accent perception, like speech perception in general, is not achieved through a mirror image input into the listener's mind of the values of the physical properties of the signal, but by

normalizing these values for various speakers (Pierrehumbert, 1979; Ladefoged and Broadbent 1957; and Klatt and Cooper 1975).

(5) The physical correlates of accent function as attention markers with no linguistic content in themselves.

Theories and Models of Speech Perception

Different theories and models of speech perception have attempted to explain how the perceptual prominence of accented, versus unaccented, syllables is recognized by listeners.

Each of those theories and models has been advocated by various investigators over long periods of time. Our review below does not aspire to give an exhaustive list of all exponents of such theories but rather a brief account of the central notions underlying each. This is why the chronological order was not taken into account in the choice of representative studies reported. Couper-Kuhlen (1986: 25-26), in a brief summary of such theories and models, reports the "transducer" model of speech perception. She quotes Grundstrom (1979: 43) as saying:

"... we have taken for granted that most of the information which listeners used to perceive prosodic meaning was there in the acoustic signal; all the investigator had to do was to find out where the information was located and how it was signalled. If listeners could identify prosodic functions in speech, then so could an intelligent acoustic analysis."

This model, as such, regards the acoustic input as all that listeners use to perceive the prosody of the signal, including its accentual prominence. The fact that Lieberman (1960) devised a computer program for automatic accent detection, which correctly

detected the accents that human listeners already agreed upon in 99.2% of cases, would seem to support this model. It is doubtful, though, as Couper-Kuhlen notes, that the way such programs take decisions, successful as they are, is similar to the way man perceives accent.

McNeil and Repp (1973) modify the "transducer" model into a so-called "inductor" model. According to this model, speech perception is an "autonomous" mechanism that need only to be "triggered". For a certain linguistic feature to be perceived, only one of a set of relevant cues is needed to do the "triggering", and such a set of cues does not have to be acoustically similar.

As far as the perception of accent is concerned, this model has an advantage over the preceding model in that it explains how accent is perceived despite the fact that no single acoustic parameter has been found to be in consistent correlation with it (Ladefoged 1967a:46). The model, though, is an oversimplification of the process of speech perception for it does not explain how sub-features (in this context, the various types of accent, i.e. tonic, primary non-tonic, non-primary unreduced, unaccented) are perceived and how they relate to each other. Besides, it, like the transducer model, does not explain the fact that speech perception is different from non-speech perception (Lieberman et al, 1961, 1964, 1967, 1970 - all cited in Studdert-Kennedy et al, 1969).

The perception of accent is rightly explained by the motor theory of speech perception. Couper-Kuhlen (1986: 26) describes it thus: "The contention is that we perceive speech sounds by reference to the articulatory movements which we ourselves would have to make in order to produce the same sounds". By articulatory movements in

this context is meant the participation to a major or a minor extent of the sublaryngeal, laryngeal, and supralaryngeal peripheral systems in the production of speech (see the Section on the physiology of stress, page 37 ff).

Cooper et al (1975, 1976), for instance, report results which support the existence of an auditory motor processor that is used in speech production and perception. Lieberman (1960, 1970) stresses an important fact, namely that the theory does not imply conscious knowledge on the part of the listeners, of such a median stage between the speech signal and the process of perception of that signal: "People "know" many complex relationships at some neural level without any conscious knowledge of the fact" (1970:198).

The theory, or at least its implications, has been expounded with reference to the perception of accent by various investigators (e.g. Gimson 1956; Liberman 1957; Fonagy 1966; Liberman 1968; Lehiste 1970:18-19; Katwijk 1972; and Couper-Kuhlen 1986:26). Katwijk concludes:

"The process of stress perception appears to be tuned to the process of stress production. The pulse-like effort gestures that are operative in the sub-and supraglottal systems and that are associated with stress, are represented in speech by a number of cues, of which pitch is an important one. Pitch patterns are not only indicative of articulatory stress gestures, they are also indicative of laryngeal and respiratory postures...".

Our review above of the literature on the perceptual correlates of accent has made it clear that it is not only "pitch patterns", as Katwijk indicates, that signal accents in speech. Vowel quality, subjective duration and loudness or the last two jointly as

intensity integral are important as well. The point at issue, here, is that combinations of these factors, or at least of some of them, evoke the sensory effects of the articulatory movements characteristic of the production of accent in the listener's brain. Bannert (1987) visualizes the process of accent perception in a model of speech perception that is compatible with this as a two-directional scheme: "bottom-up" for information emanating from the speech signal and "top-down" for information stored in the brain of the listener.

A model with a somewhat similar approach is that of "analysis-by-synthesis" (Stevens and Halle 1967; Stevens 1968). According to this model, the listener synthesizes the phonological rules of the speech signal and does not have to neurally retrieve the sensory effects of the articulatory movements underlying that signal as implied by the motor theory. Stevens and Halle (1967) argue the adequacy of this model on the basis of the assumption that to understand the utterance of a speaker, a listener does not have to be able to produce that utterance perfectly as is the case of foreign learners of a language. However, results of the Perception Test described in Part 2 below indicate that there are marked differences in the patterns of locating the place of the primary accent between native and non-native speakers of English. These differences may be indicative of differences in the perceptual strategies employed by the two groups of speakers.

(ii) The Effect of Accent on the Perception of Speech:

It has been noted that to accent some syllables in speech and not to accent others is an added constraint that aims at achieving

a measure of facilitation in the process of speech production (Fowler 1977: 158-159). That is to say, a major articulatory movement is that involved in the production of an accented syllable and intervening unaccented syllables are produced by minor movements that are carried out while heading to another major movement. The effect of accent on the perception of speech, on the other hand, has been noted from various standpoints as follows:

1. The Lexical Level:

This approach is based upon the presupposition of the existence of a word-store in the human mind called "the mental lexicon" (e.g. Aitchison 1987:9). The accentual pattern of the word is part of its stored image (cf. Cutler and Isard 1980). During the perception of an utterance, that accentual pattern is part of the identification of the word (Cutler 1984). Thus, accent participates indirectly through the alternation of accented and unaccented syllables in the identification of words and the understanding of longer stretches of speech. Kozhevnikov and Chistovich (1965: 245) report that Lichten (1951) had shown that the task of word identification is further facilitated by the context of the sentence which reduces the number of potential words from which to choose. In an article on errors in accent placement, Fromkin (1977) argues, in a similar approach to that of Culter (1983b), that the perception of an error requires the knowledge that a rule exists. Such knowledge belongs to what she calls "internalized grammar" rather than to a set of "output conditions" as argued by Derwing (1973 - cited by Fromkin 1977). In a study of the perceptual parsing of monomorphemic monosyllabic sequences, Nakatani and Schaffer (1978) find that the accentual pattern is a cue for word perception while the pitch pattern is not.

2. The Segmental Level:

It has been found that the perceptual prominence of accented syllables, as contrasted with unaccented syllables, reduces the reaction time (R.T.) to the word-initial phonemes constituting them, as in the Cutler and Foss study (1977) reported above. Presenting their listeners with synthesized words like TASK vs DASK, and TASH vs DASH, on the one hand, and TIGRESS vs DIGRESS on the other hand, Cutler and Clifton (1983) found that listeners' perception of the segmental contrasts in these series was affected by segmental information only in the first set, while it was affected by segmental information together with accentual variation in the latter.

3. Semantics and Rhythm:

The effect of accent on speech perception has also been studied in relation to these levels. Terken's (1983) listeners viewed a display showing changes in a letter configuration. After each change, they were presented with an audio description of it, which they had to judge as true or false as soon as they could. Accentuation (i.e. that given words received tonic accents) was manipulated as appropriate or inappropriate on the basis of the given/new information structure (cf. Brown et al 1980). It was found that appropriate accentuation resulted in faster decisions. Cutler (1983b) tested this potential relation between the information structure and the appropriateness of accentuation by means of the phoneme-monitoring reaction-time technique. Varying the information structure by excising given utterances from one context and embedding them in another, she managed to manipulate the

appropriateness of accentuation. R.T. was found to be shorter when the semantic "focus" of the sentence coincided with accent, than when the two conflicted. She even speculated that "... the accent effect and the focus effect are likely to be alternative reflections of the same comprehension strategy" (1983b:89).

As for rhythm, Kozhevnikov and Chistovich (1965: 238-249), studying Russian phrases transmitted in noise, found that the phrases their listeners recorded, as the ones they heard, accurately reflected the rhythm of the alternation of accented and unaccented syllables in the transmitted phrases, though the misperceptions of vowels and consonants were as high as 50% and 60% respectively. In fact the faster R.T. for accented syllables reported by phoneme monitoring experiments, like the Cutler and Foss one (1977) reported above, has been attributed by Darwin (1975), interpreting the result of an earlier experiment (Cutler and Foss 1973 - cited by Darwin 1975), to the anticipation created by the rhythm of the alternation of accented and unaccented syllables rather than to the intrinsic nature of accented syllables. His argument is based on two strong pieces of evidence:

(i) that reaction time was found to be longer earlier in long utterances, that is, when the rhythmic pattern has yet to be grasped by listeners (Shields et al 1974, cited by Darwin 1975). This evidence has been supported by Buxton (1983).

(ii) Local disturbance of rhythm influences the R.T. (Cutler 1975, cited by Darwin 1975).

Though these pieces of evidence prove that faster R.T.'s to accented syllables are due to the extrinsic patterning of accented and unaccented syllables rather than to the intrinsic perceptual

prominence of such syllables, they cannot undermine the role of accent in achieving the perceptual phenomenon of rhythm itself.

Summary

The review of the literature included in (ii) has shown quite clearly that while accent has a facilitatory effect in the process of speech production, it also affects the perception of speech in four ways:

1. The accentual pattern of words helps in identifying the words in the course of perception of longer stretches of speech while the context of such stretches reduces the number of options in the mental lexicon from which to choose.
2. The perception of segments is partly dependent on whether they occur in accented or unaccented syllables.
3. Though partly achieved by the context, semantic focusing is best perceived when the information structure of the context is reflected by the appropriateness of the phonetic accentuation.
4. The rhythm of the alternation of accented and unaccented syllables helps in the perception of speech in that it creates linguistic auditory coherence.

Part 2: The Perception Test

As indicated in the opening Section of this Chapter, the aim of this Part is to describe a perception experiment that we carried out with the purpose of testing some further hypotheses and to relate the results to the hypotheses and theories formulated by research in this area as reviewed in Part 1 above. Our main concern here is with the direct relation between accent and perception, namely the

perception of accented syllables themselves. The task through which this aspect is studied is the location of the most prominent syllable in the word (i.e. the one with the primary tonic accent) in one-word utterances and in the target words in a few longer utterances. This task is a direct one compared, for instance, with its counterpart in R.T. experiments in this respect where the task is to respond to a word-initial phoneme. Designed as such, the Test is intended as a contribution to the (i) area of research described in the literature review above.

Methods:

(i) Material:

Ninety-four words were selected from the EPD to form the material for the Test. These words fall into groups as follows:

1. Some of the words whose primary accents were misplaced by the non-native informants S11 and S12 (in their recording of the material analysed in Chapters II and III) were included in the material for this Test. Words of this sort (e.g. TEMPORARY, ADEQUATE) form the material for Sub-test 1.
2. Some of the words included appear with two accentual variants in the EPD (e.g. adult / ^ædʌlt / or / ə^ədʌlt/). Both variants of these words are included in the Test but not subsequently. In fact, they are separated by six words at least. Words of this sort form the material for Sub-test 5.
3. Some words with deliberately misplaced primary accents (e.g. ^əMENTALITY, COM^əPOST). This group forms the material for Sub-test 3.
4. A group of words where the accented syllables have the same vocalic nucleus and varying syllable-weights ranging from CCVCC to V

(e.g. \EVIDENT, \PELICAN etc). This group forms the material for Sub-test 6.

5. A group of word-pairs where each pair is derivationally related and the two syllables that receive the primary accents are not the same (e.g. SUB\STANTIAL and SUBSTANTI\ATION). This group forms the material for Sub-test 7.

6. Some compound words (e.g. COCA-COLA, EASTER-DAY). These words are the material for Sub-test 8.

7. A group of words where each involves a contextually justifiable shift of accent. This group comprises six words, two in each of the three sentences included in the Test (e.g. I SAID HARM\FUL NOT HARM\LESS - where the target words are those underlined). This group forms the material for Sub-test 4.

8. All the words of the Test, some of which are not included in the groups described above are considered in two distinct groups:

A. words that comprise more than one prominent syllable. A prominent syllable in this context is taken to be one that:

(a) lexicographically receives a primary or a secondary accent (e.g. the underlined syllables of EVIDENTIAL),

(b) syllables that we have described as receiving secondary-like accents (e.g. the underlined syllables in EXERCISE, HABITAT). This latter type includes the syllables lexicographically accented in words with deliberately misplaced accents (described in 3 above) and in those with accentual shifts (described in 7 above)

B. words that comprise no more than one prominent syllable (e.g. TEMPORARY, ESTIMATE(n.), SENTIMENT).

All the words of the Test ,classified as such form the material for Sub-test 2.

(ii) Organizing the Material for Recording:

Apart from the material for Sub-test 4, the words of the Test were randomly distributed in the form of a list. This random distribution had to take into account the condition peculiar to Sub-test 7 that non-target words had to occur earlier than their target counterparts. In this case, they had to be separated by at least 6 words.

Phonetically transcribed versions of some of the words were provided side by side with their orthographic versions. Those words included the material for Sub-tests 3, 4, 5 and some of the material for Sub-test 8. Phonetic transcriptions for those words were provided since specific accentual variants or deliberate deviations from the normal pronunciation were required. A few words from different Sub-tests had also to be phonetically transcribed to avoid unwanted segmental variations (e.g. ESTIMATE /^ˈestɪmənt/ rather than /^ˈestɪmənt/ , SEPARATE /^ˈsepəreɪt/ rather than /^ˈsepəreɪt/ . Since the material for Sub-test 4 consisted of the only three sentences in the material of the Test, it was placed at the end of the list.

(iii) Recording the Test Material:

The material was recorded in a sound-proof room in the Audio-Visual Centre of the University of Glasgow. It was recorded by means of a NAGRA-IV S tape-recorder on AGFA PEM 369 PROFESSIONAL tape with the microphone 18 inches away from the informant. The informant who recorded the material was a native male speaker of English. He was a professional phonetician who was best suited to achieve the required manipulations of the material. Each word (and sentence) was uttered twice. The recorded material lasted 7 minutes

and 5 seconds approximately. The master tape was copied in the Phonetics Laboratory of the University of Glasgow. Using the PAUSE facility, the time span between the two tokens of a given word and those of the next one was extended to the time for five finger tappings. This was done by the use of a twin-deck TEAC A-3440 tape-recorder. In this extended version, the recorded material lasted 12 minutes and 20 seconds approximately. The time span between each word and the next one was thus on average 3.8 seconds approximately.

(iv) Judging Informants:

The number of people that participated in the judgement of the material totalled 16 informants. These were classified into three groups as follows:

1. Non-native speakers of English. These were 8 informants (S9 to S16). They were all Arabic speakers who came from different countries: Algeria, Egypt, Iraq, Libya and Syria. These were chosen because they were non-native speakers of English rather than because they were Arabs. The coincidence that they were all Arabs was due to the fact that they were the ones available for the present investigator. They were all postgraduates ranging from 26 to 40 years of age. They will be referred to henceforth as Group 1.
2. Native and phonetically naive speakers of English. These were 6 informants (S3 to S8). S3 and S4 were themselves the S3 and S4 who recorded the material analysed in Chapters II and III above. This group ranged from 35 to 55 years of age. They will be referred to henceforth as Group 2.
3. Native and phonetically aware speakers of English. These were 2 informants (S1 and S2). They were themselves the S1 and S2 who

recorded the material analysed in the preceding two chapters. Describing them as phonetically aware should not be taken to imply that they are professional phoneticians. They are rather professional linguists who are thoroughly familiar with the basics of phonetics and phonology. They will be referred to henceforth as Group 3.

(v) Administering the Test:

The recorded material was written down in the very order it was recorded in a word-per-line list extending over the space of seven pages. A syllabified version of each word was provided besides its orthographic version. In this syllabified version, blank spaces were left to mark syllable boundaries. In the opening three words of the list, the accented syllables were underlined, while the words themselves were derivationally related ones with varying places of accent. These three words were meant to be an example that would guide the informants to what they were required to look for on listening to the list. As for the three sentences at the end of the list, only the target words were syllabified. Note that syllabification was carried out according to the principles spelled out in the introduction to Chapter II.

Before getting each individual informant to listen to the tape, he/she was asked to read a one-page set of instructions (Appendix 4). On the whole, the instructions aimed at explaining the lay-out of the Test material. The aim of the experiment was broadly described in these words: "to study a certain aspect of English pronunciation". It was indicated that syllabification of the material sometimes used "a more phonetic spelling". This refers to

cases such as EXERCISE which had to be syllabified as "ek ser cise". The task required from the informants was specified as the underlining of "the part you perceive as most prominent, or loudest, or the one you feel stands out from the rest" in each word, or target word in a sentence. It is clear in this wording that the linguistic terms "syllable" and "accent" were abandoned for the sake of others that were more familiar to the layman.

The re-recorded tape was played to each informant alone using a UHER 4000 REPORT-L tape-recorder. Some of the informants took the Test in the Phonetics Laboratory of the University of Glasgow; some in their own offices; and some in the study-room of the present investigator.

Results of the Test

The results of the Test are to be analysed from two inter-related standpoints under these two headings:

A. Informant-based analysis.

B. Material-based analysis.

A. Informant-based analysis. Our aim in this Section is to consider how far the hypotheses underlying our classification of the informants into Groups 1, 2 and 3 are plausible. When this classification was adopted, three hypotheses were envisaged:

(1) According to the motor theory of speech perception, native speakers of English compared to non-native speakers should achieve on average higher percentages of correct judgements of the place of the tonic accent. That is, they would be more able to match the advantage the accented syllables have in terms of acoustic prominence with the advantage they themselves would characterize

those syllables with in terms of physiological effort; and thus they would be more able to locate those syllables in the utterance of fellow native speakers. Non-native speakers of the language, on the other hand, would not have that capability of "matching" since they might or might not pronounce the words correctly. Indeed they might or might not be familiar with the words in the first place.

This hypothesis will be tested by comparing the percentage of correct judgements for Group 1 and that for Group 2. Group 3 is not compared in this respect to Group 1 since the former have the advantage of being linguists.

(2) The second hypothesis envisaged for classifying the informants is that academic knowledge of the feature "accent" might give linguists an advantage over non-linguists in judging the place of accent. This hypothesis will be tested by comparing the percentage of correct judgements for Group 2 and that for Group 3.

(3) The third hypothesis is that the pattern of incorrect judgement of the place of accent might prove different for native and non-native informants. That is, the incorrect choice of syllable by non-native informants might be biased towards a different type of syllable from the one the native informants would opt for. This hypothesis will be tested by comparing the pattern of incorrect judgement for Group 1 with that for Group 3.

The results of the informant-based analysis were as follows:

(i) The informants of Group 2 achieved percentages of correct judgement ranging from 50% for S6 to 100% for S3 and S4; the average was 77.3%. The informants for Group 1, on the other hand, achieved percentages ranging from 36.2% approximately for S12 to 83% approx. for S9; the average was 61.2% approx. Thus, there is indeed a

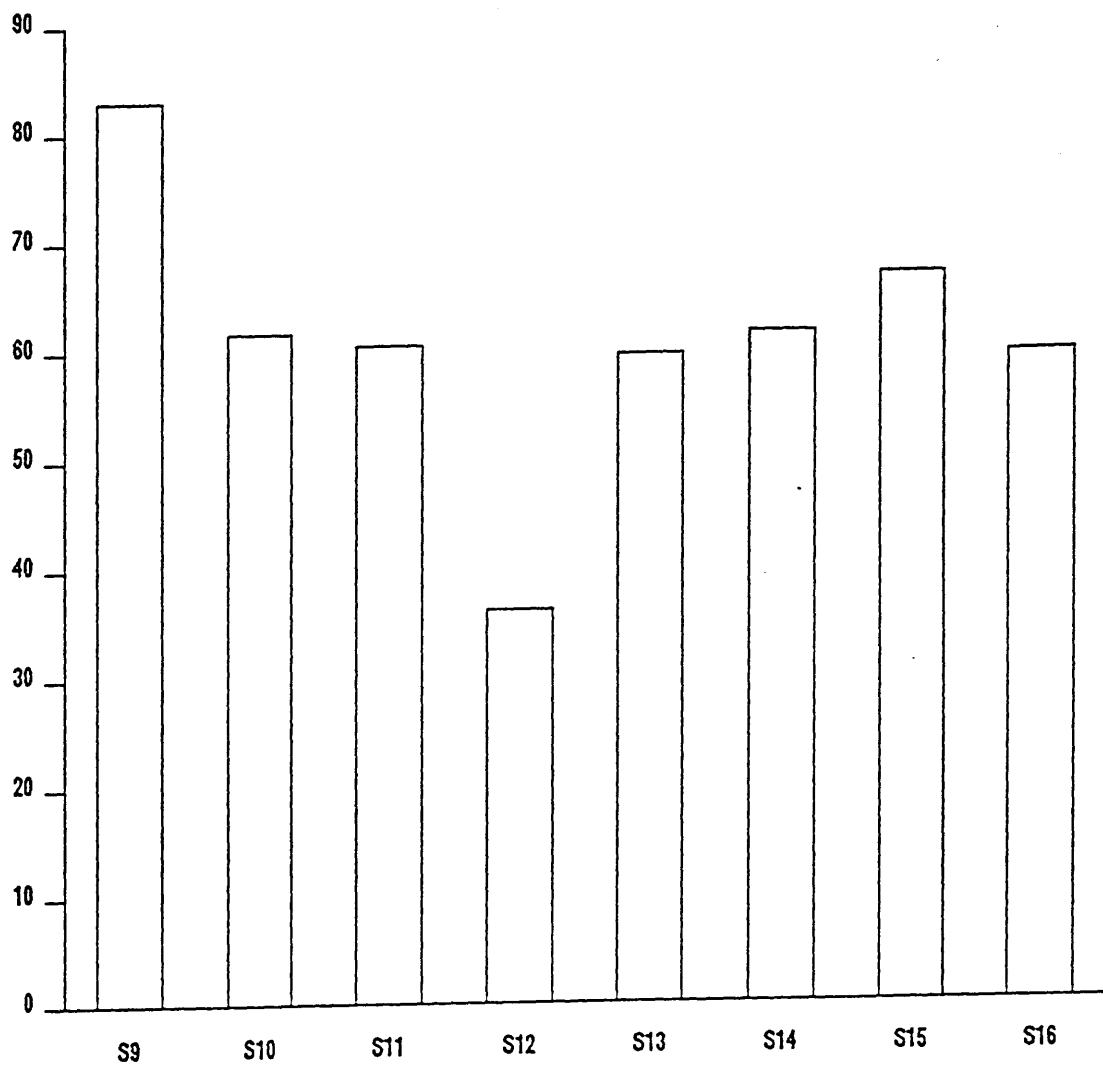


Figure P1: Percentages of correct judgements for each individual informant of Group 1 (non-native speakers of English).

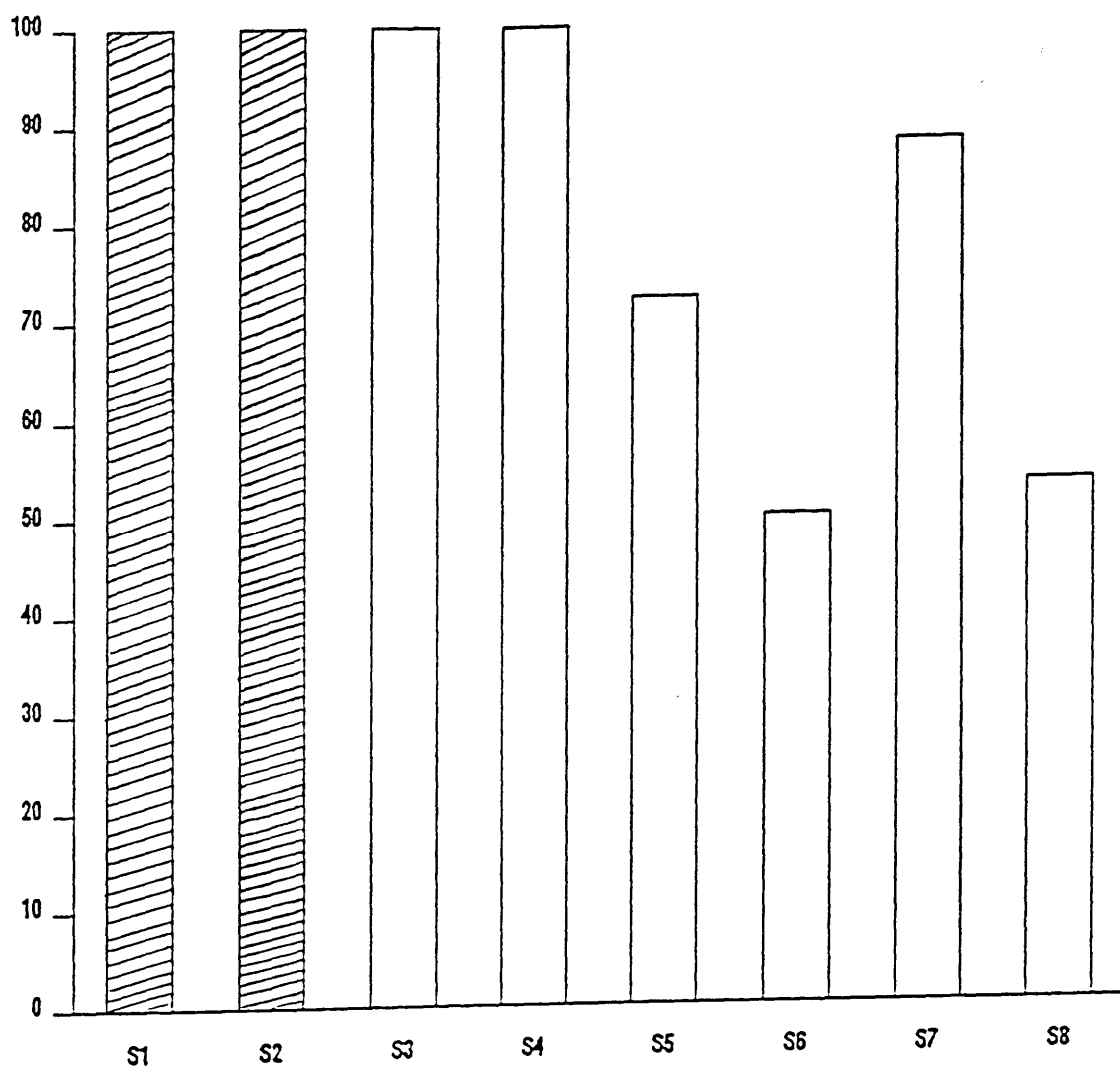




Figure P2: Percentages of correct judgements for each individual informant of Group 2  and 3  (native speakers of English).

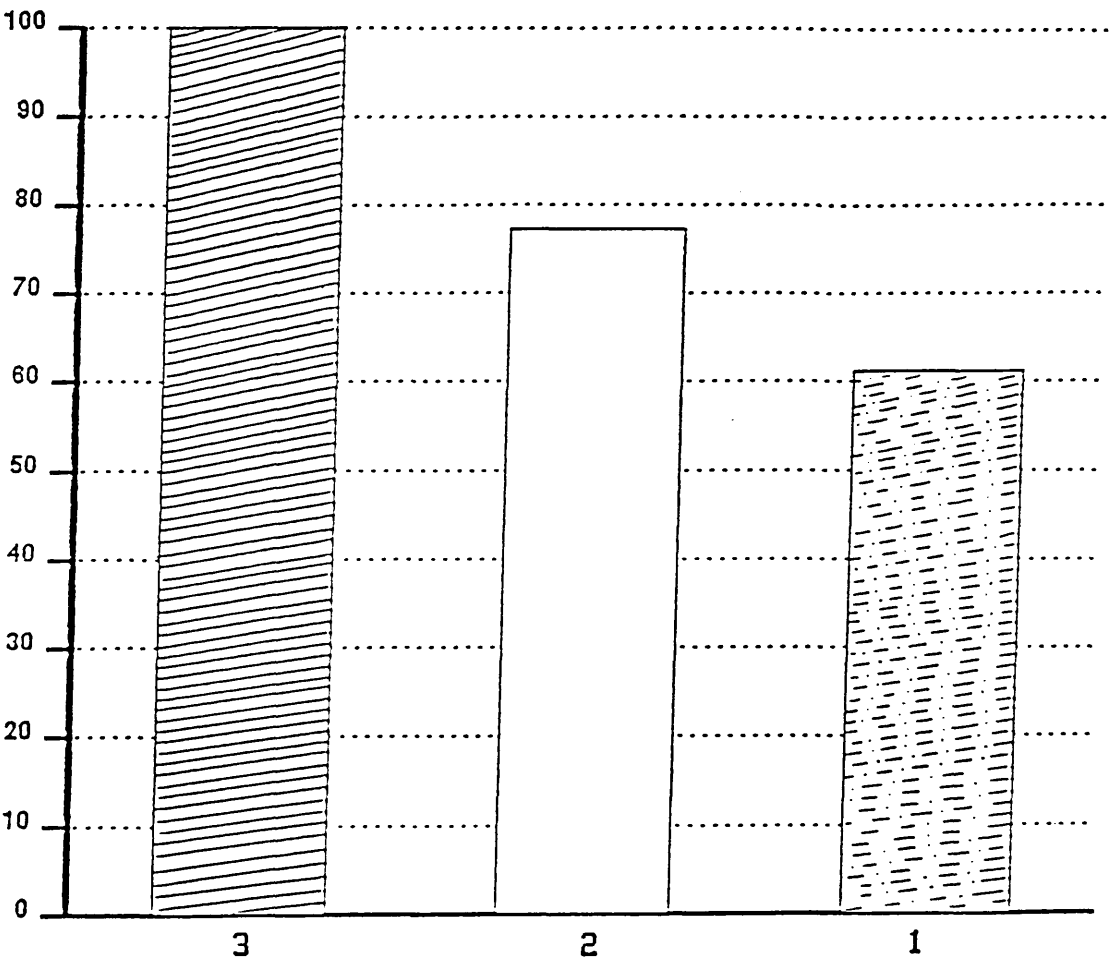





Figure P3: Average percentages of correct judgements for Group 1 , 2 , and 3  informants.

reasonable margin of difference amounting to 16.1% between the percentages of correct judgement between these two Groups of informants. This result supports hypothesis (1) above that there might be an advantage for native speakers over non-native ones in terms of the correct judgement of the place of the primary tonic accent.

(ii) Whereas the ordinary native informants (i.e. who are non-linguists) of Group 2 achieved a percentage of correct judgements averaging only 77.3% approx., the phonetically aware informants of Group 3 both achieved the maximum score of 100%. This result supports hypothesis (2) above that familiarity with linguistic concepts which of necessity include some knowledge of phonetics and phonology does give an advantage for the linguists over the laymen in judging the place of primary tonic accent. See Figures P1 and P2 for Histograms of the percentages of correct judgement achieved by individual informants. Figure P3 gives the average percentage for each Group collectively.

(iii) Analysing the types of incorrect judgement for each individual informant, we detected four patterns as follows:

a. Confusing the accented syllable for an adjacent prominent syllable. As defined in 8 above, a prominent syllable is taken to be one that lexicographically receives a primary or a secondary accent, or one that belongs to what we call the secondary-like category of syllables (e.g. ESSAY by S6, MOUTHORGAN by S10, where the underlined syllables are the ones judged to be accented).

b. Confusing the accented syllable for an adjacent non-prominent one (e.g. ADEQUATE by S5, UNDERSTAND by S14, where the syllable underlined is the one judged to be accented). We assume

that this pattern of incorrect judgement which is commonest of all patterns occurring predominantly in polysyllabic words (with the exception of 5 out of 125 cases for non-native informants and 1 out of 69 cases for native informants) is the nearest thing to a correct judgement. On making this incorrect judgement, informants probably correctly realized how early or how late in the word the accent is but the precise location of the accented syllable was incorrectly judged.

c. Confusing the accented syllable for a non-adjacent prominent syllable (e.g. SUBSTANTIATION by S7, HOGMANAY by S11, where underlined syllables are the ones judged to be accented). Opting for the prominent syllables as in the a and c patterns has been noted by Fonagy (1966) for both native and non-native speakers of the target language.

d. Confusing the accented syllable for a non-adjacent non-prominent syllable (e.g. MOUTHORGAN by S8, DEPORTED by S12 - where the underlined syllable is the one judged to be accented).

Figure P4 represents by histograms the percentages for the four patterns of incorrect judgement made by Groups 1 and 2. This figure shows that pattern b is the most frequent for both Groups, followed by pattern a, then c ; pattern d is the least frequent. There are, though, significant differences between these two Groups; non-native informants had a greater tendency to opt for another prominent syllable in the word (an extra 11.8% of their incorrect judgements occurring in the a and c patterns), whereas native informants had a greater tendency to opt for an adjacent non-prominent syllable in the word (an extra 11.1% of their incorrect judgements occurring in the b pattern). Besides

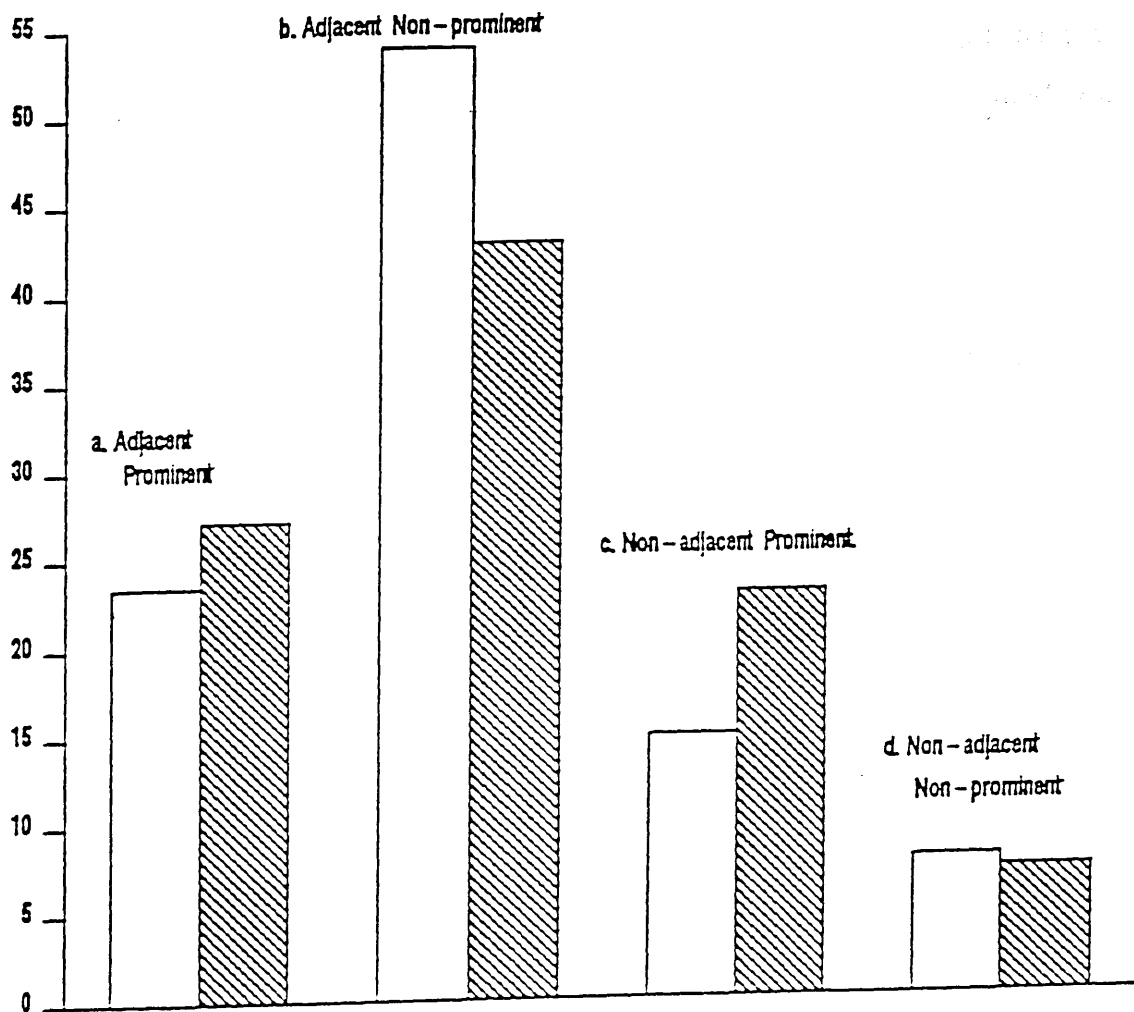




Figure P4: Average percentages of the four patterns of incorrect judgements made by Group 1  and 2  informants.

supporting hypothesis 3 above, this result also supports hypothesis 1. We argued above that pattern b is the nearest thing to a correct judgement. The fact that an extra 11.1% of the incorrect judgement of native informants belong to pattern b suggests an added advantage to their extra 16.1% in terms of correct judgements. This is in line with hypothesis 1. Besides, the very fact that incorrect judgements were less frequently biased for another prominent syllable in the word is also an advantage for them over non-native informants that further supports hypothesis 1. Pattern d (i.e. confusing the accented syllable for a non-adjacent, non-prominent syllable) is understandably the least frequent for both Groups. Native informants have a negligible extra 0.7% of incorrect judgements belonging to this pattern. Many instances of this pattern have been caused by the bias towards syllables of heavy syntagmatic structure (e.g. SENTIMENT by S8, SIGNIFICANCE by S14 and S15, COUNTENANCED by S11 and S12) or towards syllables constituting a glide or participating in one (e.g. MATRIMONIAL by S5, TERRESTRIAL by S8). The underlined syllables in these examples are the ones judged as accented.

Figure P5 represents the results in a different way: namely the average number of instances of the four patterns of incorrect judgement made by a native (Group 2) and a non-native informant (Group 1). The figure shows that pattern b has on average a greater number of instances for an informant of either Group, followed by pattern a, then c and finally d. It shows also that a non-native informant makes greater numbers of instances of all patterns. A non-native informant makes almost twice as many incorrect judgements in the case of pattern a as a native informant does, and much more

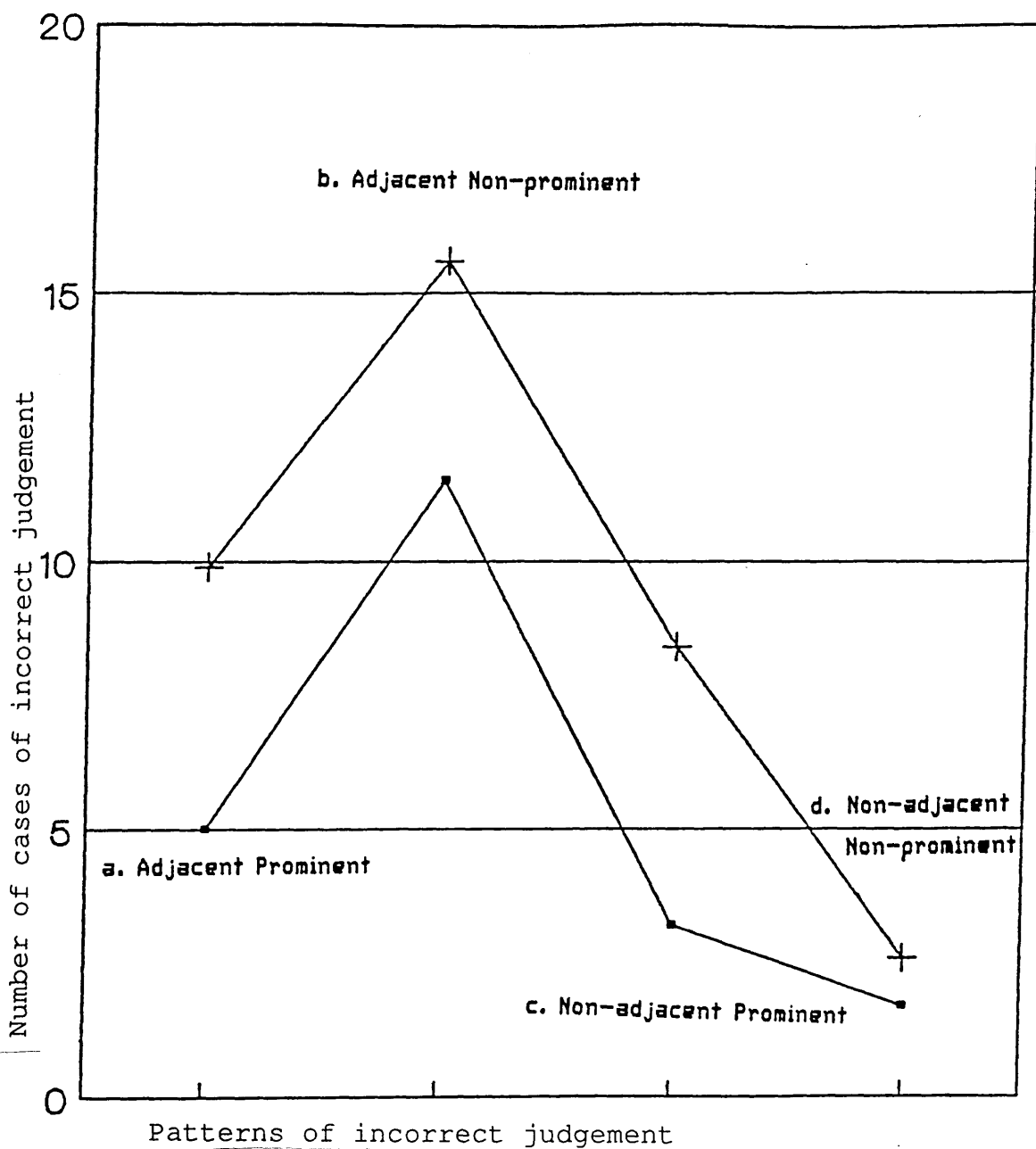


Figure P5: Average number of instances of the four patterns of incorrect judgements made by an informant of Group 1 $\text{---}+$ and 2 $\text{---}\blacksquare$. (Note that lines are not curves).

than twice as many in the case of pattern c. This indicates, as remarked in our discussion of Figure P4, that non-native informants have a greater tendency to opt for a prominent syllable in the word other than the accented one, more so for a prominent syllable that is not adjacent to the accented syllable. In the case of pattern b, a non-native informant makes more incorrect judgements than does a native informant, but not with as great a margin of difference as in the cases of patterns a and c. These results replicate the results based on Figure 4 and similarly support hypotheses 1 and 3. Figure P5 does not include S1 and S2. See page 418 for their results.

B. Material-based Analysis

In this Section, we discuss whether or not each hypothesis or group of hypotheses underlying the selection of each group of words included in the test is plausible. Results with regard to each group of words will be considered separately in a Sub-test.

Sub-test 1:

The non-native informants S11 and S12 recorded the material analysed in Chapters II and III. A sample of the words whose accents they misplaced, whether in one-word or longer utterances, was selected to form the material for this Sub-test. Appendix P1 includes this sample of words and indicates whether the judgement of the place of accent is biased by production or not.

In designing this Sub-test, we hypothesized that the extent to which non-native informants would comply with their own accent misplacements in their judgement of the place of primary accents would reflect how far the motor theory of speech perception would explain the perception of accent by non-native informants.

It was found that in 10 out of 21 cases, the place of accent was judged correctly. In 9 out of the 11 incorrect responses, the syllable judged to be accented was itself the one misaccented by the informant. This is to say that most of the incorrect judgements of the place of accent by non-native informants is production-biased. This result suggests that the motor theory of speech perception accounts well for the perception of accent. The fact that almost half of the responses were correct, rather than production-biased should not be taken to undermine the theory in this respect. It contrarily indicates that non-native informants regard their own production as open to modification and not as the unchanging model.

Sub-test 2

As described in Section (1) above on the material, all the words of the Perception Test are considered in this Sub-test as two distinct groups:

- A. Words that comprise more than one prominent syllable.
- B. Words that comprise one prominent syllable.

The aim of this Sub-test was to find out the percentages of incorrect judgement, if any, of the place of primary tonic accent made by native and non-native speakers of English. In designing this Sub-test, it was hypothesized that:

1. The margin of difference in the percentages of incorrect judgement between these two groups would be at its lowest in the case of Type B words, and would be greater in the case of Type A words. It was thus expected that native speakers would be less likely to make more incorrect judgements in the case of Type A words as compared with Type B ones. Non-native informants, on the other

hand, would be more likely to do so.

2. Cases of incorrect judgement for Type A words would be mostly the result of confusing the accented syllable for a prominent syllable in the word; the more so in the case of non-native rather than native informants.

Figure P6 shows the percentages of incorrect judgement for the two Types of words made by native and non-native informants. In the case of Type B words, native informants make incorrect judgements in 16.7% of cases, and non-natives in 35.1% of cases. That is, the margin of difference between these two Groups in this respect is 18.4%. In the case of Type A words, the similar margin is 15.5%. This result, thus, does not support hypothesis I above that the margin of difference in the percentages of incorrect judgement would be greater in the case of Type A words as compared with Type B ones. The implication of that hypothesis that non-native informants would be more likely to make considerably more incorrect judgements in the case of Type A words (as compared with Type B ones) was not supported either. In fact while non-native informants made an extra 5.5% in the case of Type A words, native informants made an extra 8.4%. These results show that judging the place of the primary tonic accent in Type A words which comprised more than one prominent syllable constituted an added difficulty for both Groups but on the whole the native informants achieved significantly greater percentages of correct judgements.

Figure 7 represents the percentages of two patterns of incorrect judgements in the case of Type A words only. These two patterns are:

1. Confusing the accented syllable for another prominent

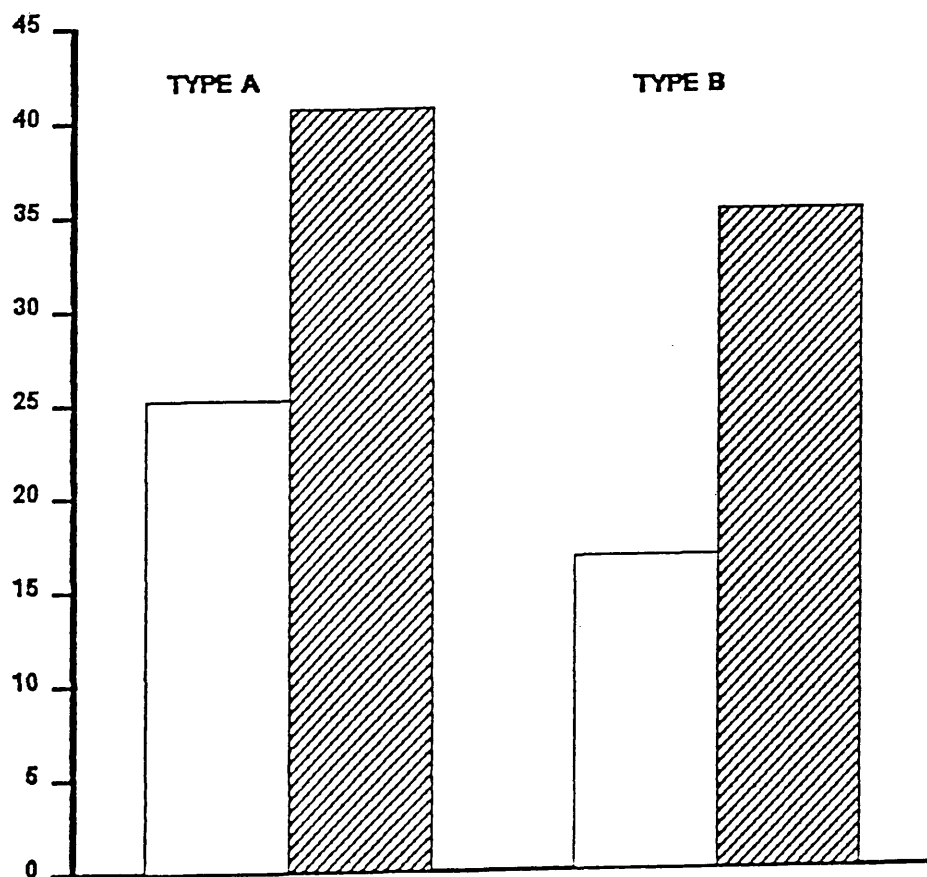




Figure P6: Percentages of incorrect judgements of the place of accent in two types of words made by native  and non-native  informants.

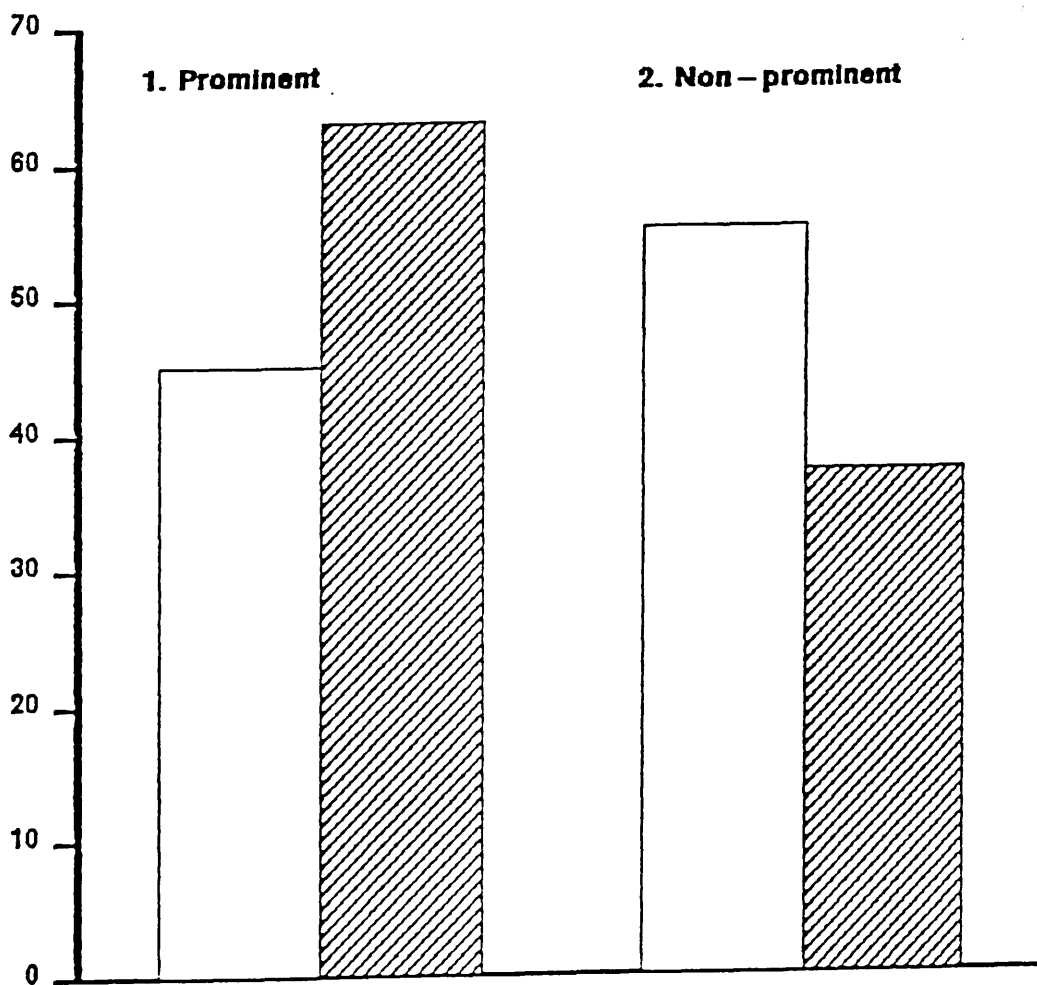


Figure P7: Percentages of two patterns of incorrect judgements of the place of accent in Type A words made by native and non-native informants.

syllable in the word (e.g. ARTIFICIAL by S6, CHARACTERISTICALLY by S7, RANSACK by S10, MATHEMATICS by S14 - where the syllables underlined are the ones judged to be accented).

2. Confusing the accented syllable for a non-prominent syllable in the word (e.g. MATHEMATICS by S5, COCA-COLA by S8, CHARACTERISTICALLY by S12, INTERDEPEND by S13).

62.9% of the incorrect judgements of non-native informants fall into pattern 1. Only 45% of the incorrect judgements of native informants fall into this pattern. Thus, while the results for non-native informants support hypothesis II (i.e. that confusing accented syllables for prominent syllables would be more frequent than confusing them for non-prominent ones), the results for native informants do not. Results for both Groups, though, are in line with those described in Section (iii) of the results of the informant-based analysis above. It was found there that 53.9% of the incorrect judgements made by native informants fell into pattern b (i.e. confusing the accented syllable with an adjacent non-prominent syllable). This was assumed to be the nearest thing to a correct judgement. In fact, the cases of incorrect judgements making this earlier percentage are themselves the ones that make up the 55% of native informants that fall into pattern 2 in this Sub-test.

Sub-test 3

The material for this Sub-test consists of 11 words with deliberately misplaced primary tonic accents (e.g. INTERDEPEND instead of, INTERDEPEND, CONSULTATION instead of, CONSULTATION). Transcribed versions of these words were provided side by side with the orthographic versions in the list given to the informant who

recorded the material. The syllables that lexicographically receive the primary accents were transcribed as maintaining their unreduced vowels (e.g. MENTALITY was transcribed /^ˈmentəleɪtɪ/ rather than /men^ˈtəleɪtɪ/. In each of these words there were, thus, two prominent syllables: the one to which the accent was shifted, and the one that is usually accented.

We aimed through this Sub-test to:

- (1) Compare the general percentages of incorrect judgement for the two Groups of informants;
- (2) Compare the results of this Sub-test, based as it is on words that all fall into Type A words in Sub-test 2, with those concerning that specific Type of word as a whole.

Figure P9 shows the general percentages of incorrect judgement in the case of these words and the percentages of when the syllable incorrectly judged to be accented is, or is not, the lexicographically accented syllable. Histograms in that Figure show that:

- (1) The general percentages of incorrect judgements are more or less of the same magnitudes as their counterparts for the two Groups of informants with respect to Type A words in Figure P6 above. The incorrect judgements for native informants are higher by 2.2%, and those for the non-native informants are lower by 4.2%.
- (2) The distribution of the incorrect judgements for non-native informants in Histograms 2 and 3 in Figure P8 is virtually the same as that of patterns 1 and 2 in Figure P7. The remarkable difference between these two Figures is in the distribution of the incorrect judgements for native informants: whereas in Figure P7 over half of these are the result of confusing the accented syllables for

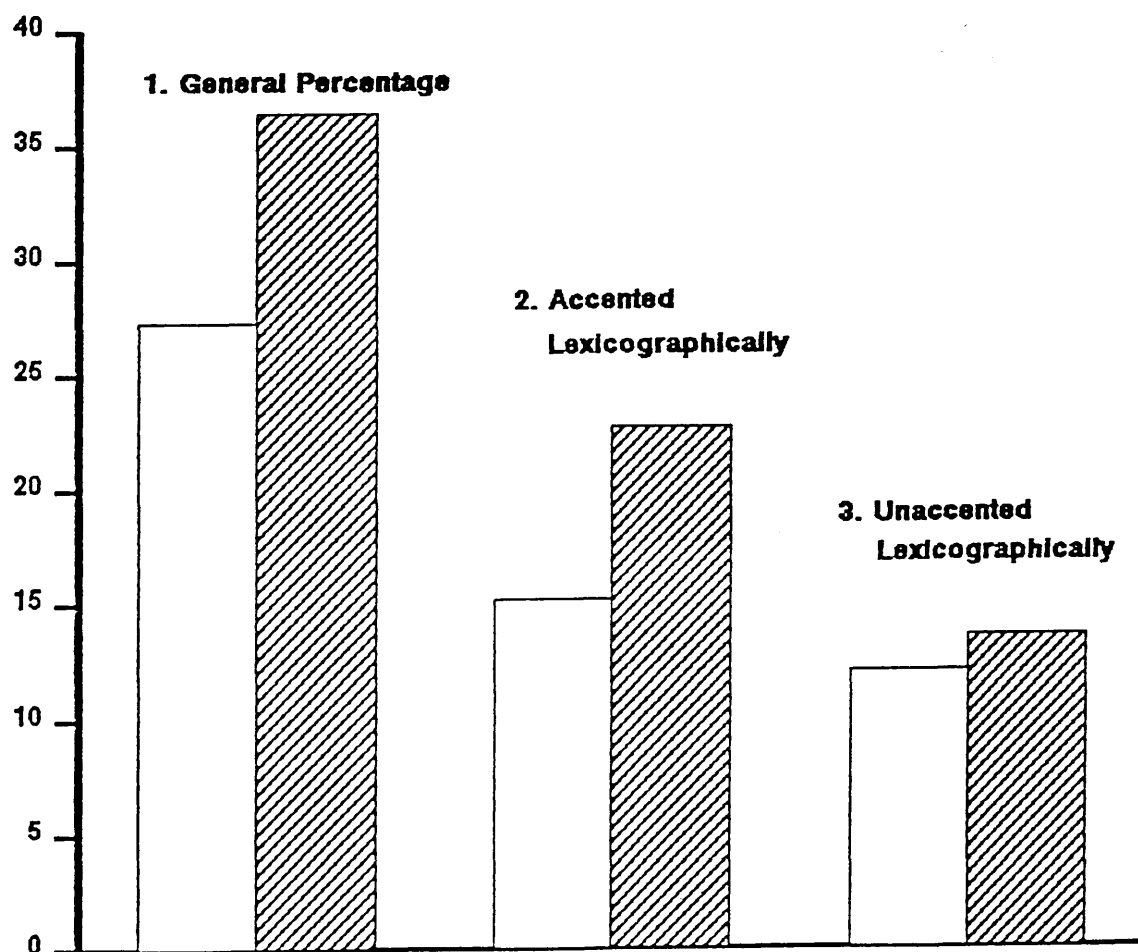




Figure P8: Percentages of incorrect judgements of the place of tonic accent made by native  and non-native  informants in the case of words with deliberately misplaced accents.

non-prominent ones; in Figure P8, over half are the result of confusing the accented syllables for the lexicographically accented ones. This result suggests that in words with deliberately misplaced accents, the judgement of the native informants are partly biased for the syllables that in their mental lexicon normally receive the accents. Another factor which may be at work here is the fact that deviation from the norm of pronunciation for the words of this Sub-test may in itself incite correct judgement. This latter factor is possible given the fact that the overall percentage of incorrect judgements is not much raised in this Sub-test compared with its counterpart for Type A words in the preceding one. One would expect such a rise if the motor theory of speech perception were to account only for the incorrect judgements. The results suggest that it accounts for some incorrect judgements directly (i.e. causing a bias for lexically accented syllables) and for some correct judgements indirectly (i.e. inciting them through the deviation from normal pronunciation). The rest of incorrect judgements could be due to the added difficulty in the task of judging the place of the primary accent where two prominent syllables are involved as is the case of Type A words in the preceding Sub-test.

Sub-test 4

The material of this Sub-test consists of 6 words with accentual shifts. Accentual shifts in this case are different from those that occur in the words of the preceding Sub-test; the latter occurred in individual words and are thus regarded as cases of misplacement, while the former, occurring in sentences involving contrast, are

regarded as contextually justifiable ones.

The aim of the Sub-test is to compare the percentages of incorrect judgement with their counterparts in Sub-tests 2 and 3. It was hypothesized that there would be a reasonable drop in these percentages in this Sub-test compared with their preceding counterparts due to the possible advantage the contrastive context might cause in terms of rendering the accentual shift prominent. A drop in these percentages would be attributable only to the context since the material in this Sub-test shares with that in Sub-test 3 the deviation from the norm, and with Type A words in Sub-test 2 and the material of Sub-test 3 the existence of two prominent syllables in each target word.

The percentages of incorrect judgement do drop from 25.1% and 40.6% in Figure P6, and from 27.3% and 36.4% in Figure P8 to 13.9% and 27.1% in this Sub-test (see Figure P9) for native and non-native informants respectively. These drops are significant enough to support the hypothesis that the contrastive context, rather than no context at all, constitutes an advantage for correct judgement of the place of shifted accents. The advantage is not peculiar to native informants only but extends to non-native informants as well. It has been found that besides the significant drops, all incorrect judgements in polysyllabic words by native informants are not biased for the lexicographically accented syllable, but for the non-prominent syllable adjacent to the accented one. This pattern of incorrect judgements had already been assumed to be the nearest thing possible to a correct judgement. It should be noted that the results for S6 and S8 are out of line with those of Group 2 informants particularly in Sub-tests 3, 5, 6, 7 and 8.

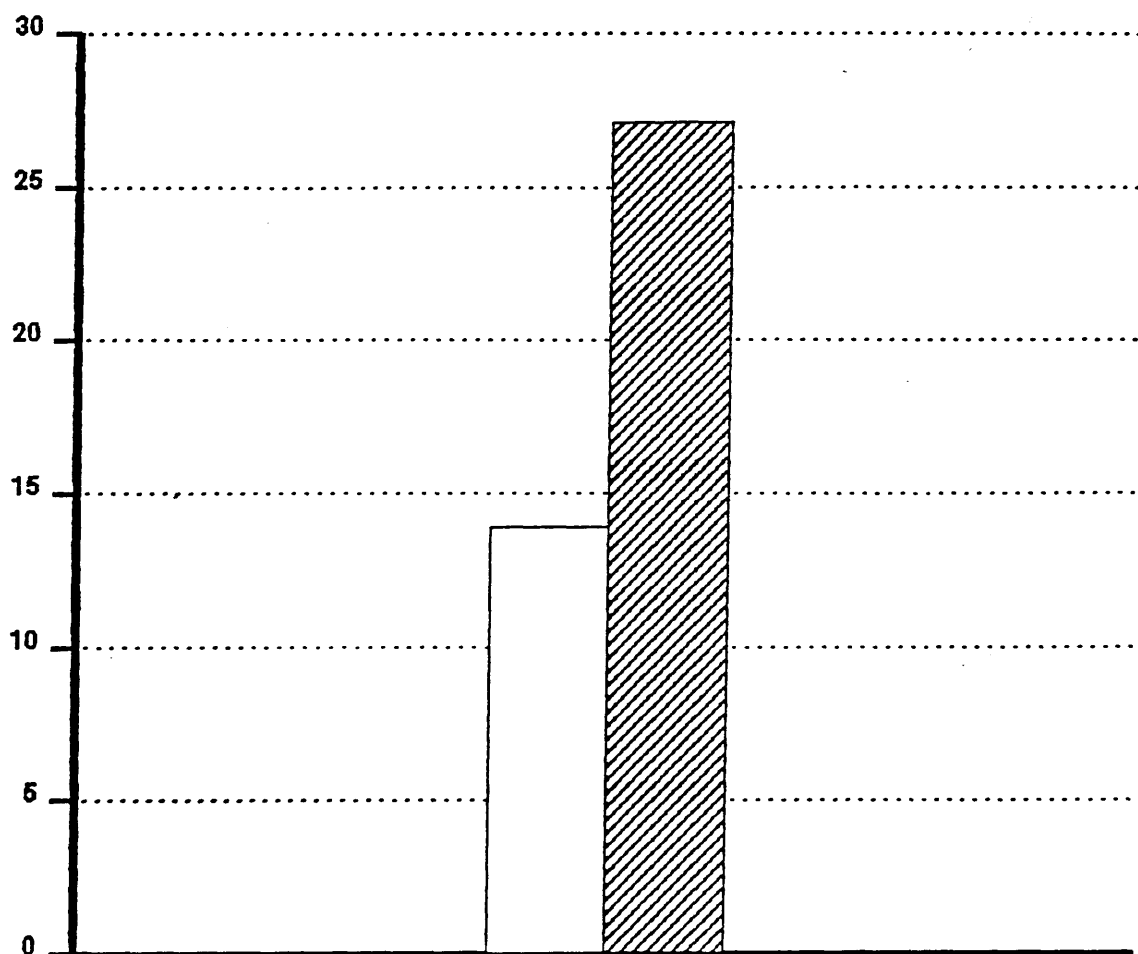




Figure P9: Percentages of incorrect judgements for the place of tonic accents in words with accentual shifts due to contrastive contexts as made by native  and non-native  informants.

Sub-test 5

The material for this Sub-test consists of 8 words, each of which is shown in the EPD with two accentual variants (e.g. GELATINE /[^]dʒeləti:n/ and /₁dʒelə̀ti:n/. Both variants of each word were included in the Test material, but they were distributed in the list so that at least six words occurred between them. Each variant was transcribed in the version which the informant who recorded the material read from.

In the case of these words, the EPD distinguishes between two kinds of variants: "common" and "less common". One of the aims of the Sub-test was to find out whether or not the informants, at least the native ones, would achieve a lower percentage of incorrect judgement in the case of the common variants as compared with the less common ones. Another aim was to find out the patterns of incorrect judgement (i.e. opting for another prominent syllable, or opting for an unaccentable syllable) for both Groups of informants.

Figure P10 gives the percentages of some parameters with regard to the judgement of the place of accent in words of this sort. The general percentages of incorrect judgement for the two Groups, as shown in Histograms in that figure, are not much different from their counterparts in Figures P6 and P8. They are, however, greater than their counterparts in Figure P9. The comparability of the general percentages in Figure 10 with their counterparts in Figures P6 and P8 indicates that judging the place of accent in the words of this Sub-test is similar to judging the place of accent in words with two prominent syllables. All the words, except for one variant of ADULT (i.e. /ə̀dʌlt/), belong, in fact, to Type A words of Sub-test 2. That the general percentages in this Sub-test are greater than those

in Figure P9 (26% compared with 13.9%, and 37.5% with 27.1% for native and non-native informants respectively) further supports the hypothesis of the preceding Sub-test that the contrastive context, compared with the lack of context, induces better percentages of correct judgement of the place of accent in words with accentual shifts (which are in a sense similar to one or the other variant of each word of this Sub-test).

Figure P10 also indicates clearly the advantage native informants have over non-native ones in judging the place of accent in these sorts of words. This is clear both in terms of the margin of difference in the percentages of incorrect judgement (26% compared with 37.5% for native and non-native informants respectively) and in terms of patterns of incorrect judgement. While non-native informants judge a prominent syllable as accented both correctly and incorrectly in 45% of cases (excluding cases with regard to the /əˈdʌlt/variant), native informants do that in 6.3% of cases only. This is in line with the results indicated in the informant-based analysis above about the tendency of non-native informants to confuse the accented syllable with another prominent syllable in the word. Unaccentable syllables in this context (i.e. those that do not receive the primary accent in either variants of each word), on the other hand, are more frequently judged as accented by native informants (in 15 % versus 9.8% of cases for natives and non-native informants respectively). This, again, is in line with the informants-based analysis about the tendency of native informants to confuse the accented syllable for a non-prominent, mostly adjacent, syllable. The margin of difference in percentages of incorrect judgement for common and less common variants (i.e.

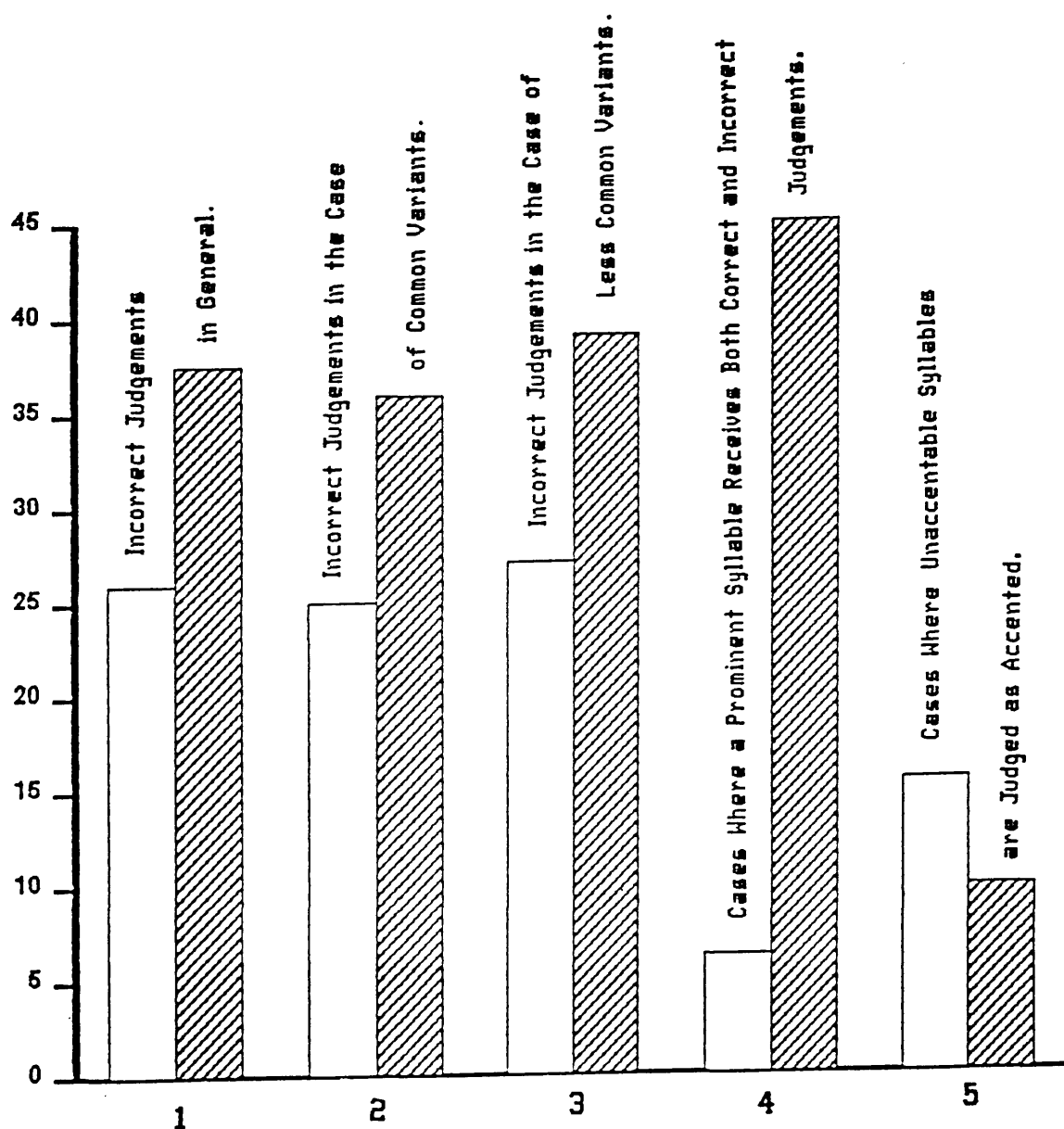




Figure P10: Percentages of some parameters with regard to the judgement of the place of accent in words with accentual variants by native  and non-native  informants.

2.1% and 3.2% for native and non-native informants respectively) is not significant enough to suggest that common variants (compared with less common ones) are more frequently correctly judged.

Sub-test 6

The material for this Sub-test consists of 13 words. The vocalic nucleus of the accented syllable in each of those words is /e/. These words are divided into 6 groups according to the weight of the accented syllable. Designing the Sub-test as such, it was hypothesized that syllables with heavier syntagmatic structures would be more frequently correctly judged than those with less heavy structures.

Figure P11 represents the percentages of incorrect judgement of the placement of accent on a given syllable as a function of its weight. The syllable weights considered are V, CV, CCV, CVC, CVCC, and CCVCC. The syllable weights CCV and CVC are considered in two separate groups, but whether the latter could be considered heavier than the former is not presumed.

Native informants make no incorrect judgements in the CCV cases, and 16.7% in the CVCC ones. Non-native informants, on the other hand, make incorrect judgements in 25% of the V cases and 37.3% in the CVCC ones. These results and others represented by Figure P11 do not support the hypothesis made above about the possibility that the number of the correct judgements could be directly proportional to how heavy the syllable to be judged is.

Sub-test 7

The material for this Sub-test consists of 6 pairs of

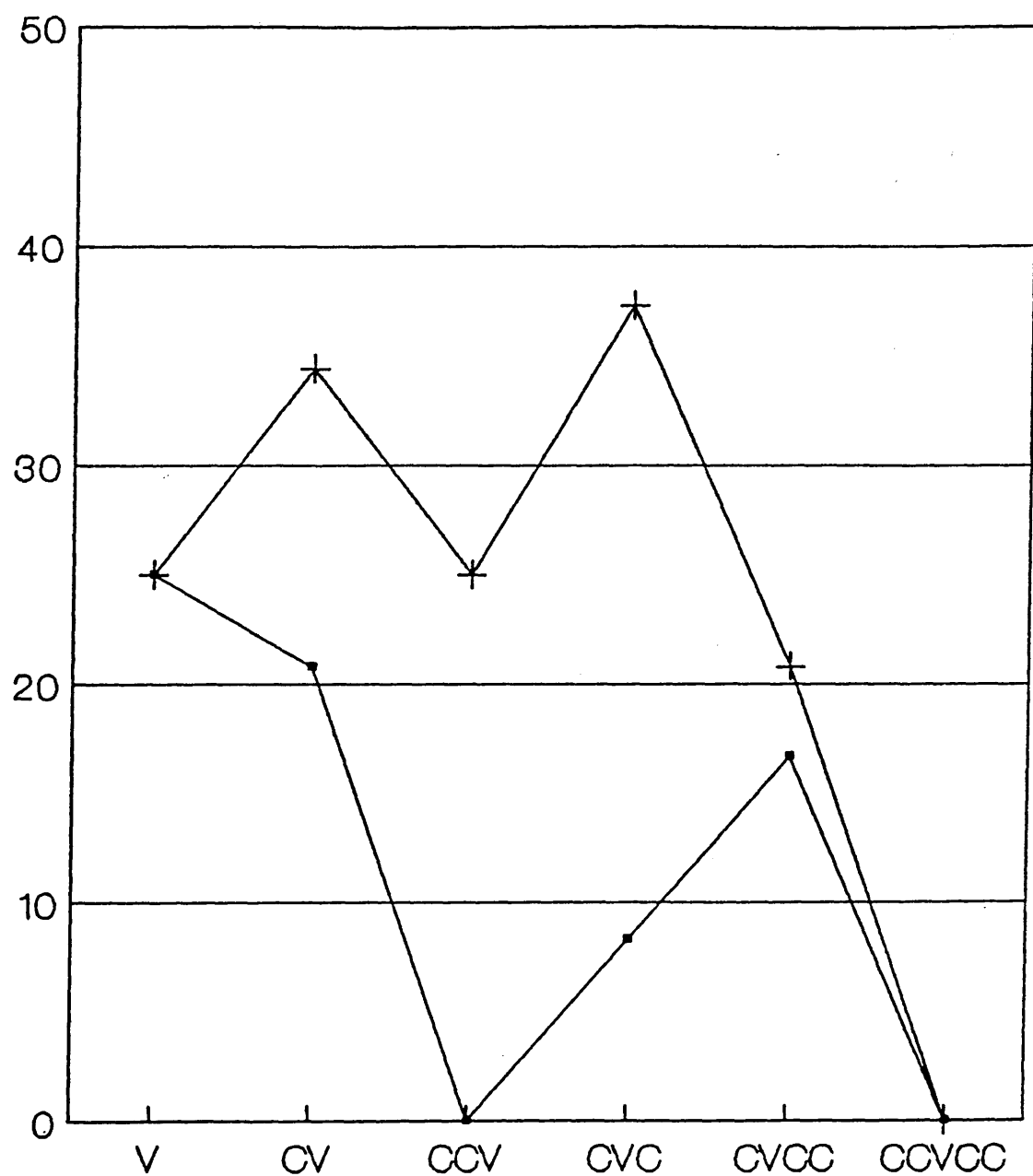


Figure P11: Percentages of incorrect judgements of the placement of accent on a given syllable as a function of its weight by native —■— and non-native —+— informants.

root-related words (e.g. SUBSTANTIAL and SUBSTANTIATION). In each of these pairs, the syllable that receives the primary accent is not one and the same in both words. Only the judgement of the place of accent in the word that occurs second in the list is considered.

The aim of the Sub-test is to find out whether the existence of a root-related word that is already judged could affect the judgement of the place of accent in a word that occurs later on in the Test Material. It was hypothesized that:

(1) Native informants would, as a result of their advantage, according to the motor theory of speech perception, maintain at least as great a percentage of correct judgements as they did in Sub-test 2 with regard to Type A words. This would also imply that they would show a comparable margin of difference over the non-native informants as they did in that Sub-test.

(2) The alternative hypothesis was that the occurrence of a root-related word earlier in the list might, as a result of the nature of the task itself, bias the judgement of the native informant towards the accented syllable in a root-related word that had just been evoked from the mental lexicon. Non-native informants, on the other hand, would be less likely to be much affected by the biases of "internalized grammar" (Fromkin 1977) since they might not be familiar at all with some words of the list. Besides, they might hold accentually incorrect pronunciations for some of the words they were familiar with.

Figure P12 represents the percentages for some parameters in relation to the incorrect judgement of the place of accent in the words of the Sub-test. Compared with the percentages of incorrect judgements for Type A words in Sub-test 2, the general percentages

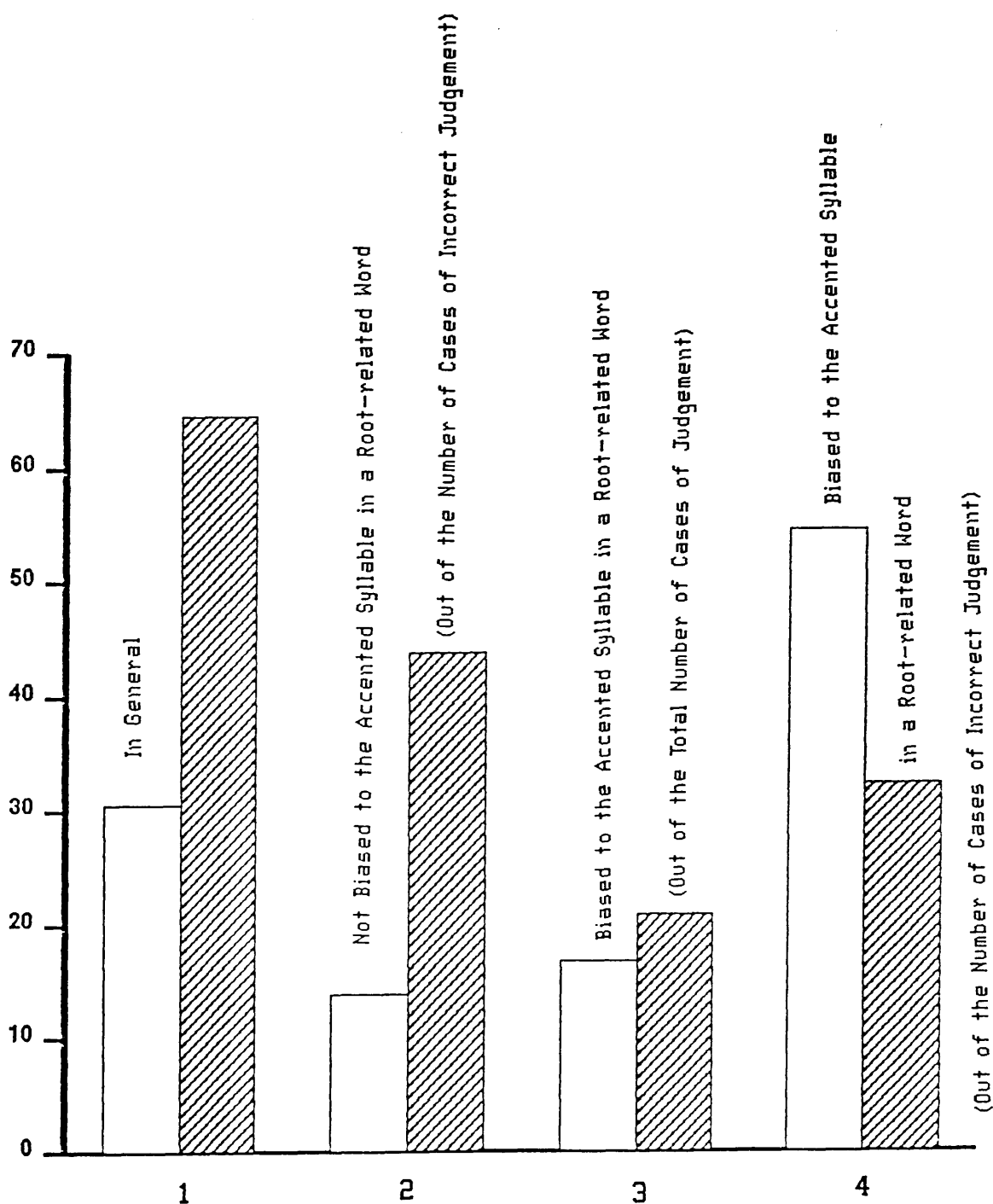




Figure P12: Percentages of some parameters in relation to the incorrect judgements of the place of accent in words which are preceded in the list by root-related ones by native  and non-native  informants.

in this Figure are greater by 5.5% and 24% for native and non-native informants respectively. Though the native informants do indeed maintain a comparable margin of difference over non-native ones in terms of the percentage of correct judgements as predicted by the first hypothesis, both Groups make more incorrect judgements in this Sub-test. There is, in compliance with the second hypothesis, a 9.5% rise in the percentage of incorrect judgements biased for a syllable that is accented in a root-related word for native informants (compared with the similar percentage for confusing the accented syllable with another prominent syllable in the word represented in Figure P7 above).

Only 32.3% of the incorrect judgements of the non-native informants are the result of confusing the accented syllable with another, that is accented in a root-related word. That is, there is a drop of 30.6% if this percentage is compared with its counterpart in Figure P7 above with regard to confusing the accented syllable for another prominent syllable in the word. Though this drop is understandable in the light of the second hypothesis about the non-native informants being less likely to be much affected by the biases of internalized grammar, there is no apparent explanation for the fact that the syllables which are accented in derivationally related words do not maintain the high percentage of confusion between accented syllables and other prominent syllables in the words — especially since they receive secondary accents in the target words of this Sub-test.

Thus the results do not support the one hypothesis or the other, but do have some bearing on some of the implications of both hypotheses.

Sub-test 8

The material for this Sub-test consisted of 9 compound words (e.g. STOP-WATCH, COCA-COLA). For a definition of the term "compound word" see Test F above. Three of these words receive the accent on the second element (e.g. EASTER-DAY) and the rest on the first one (e.g. TAXI-CAB). Each of these words comprises two prominent syllables and this is why they are all classified into Type A words in Sub-test 2 above. The aim of this Sub-test is to consider the magnitude of the percentages of incorrect judgements for the two Groups of informants in the case of these words only. It was hypothesized that non-native informants might find it particularly difficult to judge the place of accent in this sort of word.

Figure P13 presents some parameters with regard to the incorrect judgements of the place of accents in these words. Non-native informants make incorrect judgements in 41.7% of cases. This is a considerable percentage if we take into account that native informants make incorrect judgements in only 10.7% of cases. Compared with its counterpart for Type A words in Sub-test 2, this percentage constitutes a rise of only 1.1%. The result still supports the hypothesis of the Sub-test since the drop in the percentage of incorrect judgements for native informants from 25.1% in Figure P6 is not paralleled by a comparable drop in the similar percentage for non-native informants. The hypothesis is further confirmed by the fact that 76.7% of the incorrect judgements of the non-native informants are due to the confusion of the two prominent syllables in the word (compared with 62.9% for Type A words). All incorrect judgements of native informants, on the other hand, are not due to the confusion of the accented syllable for the other

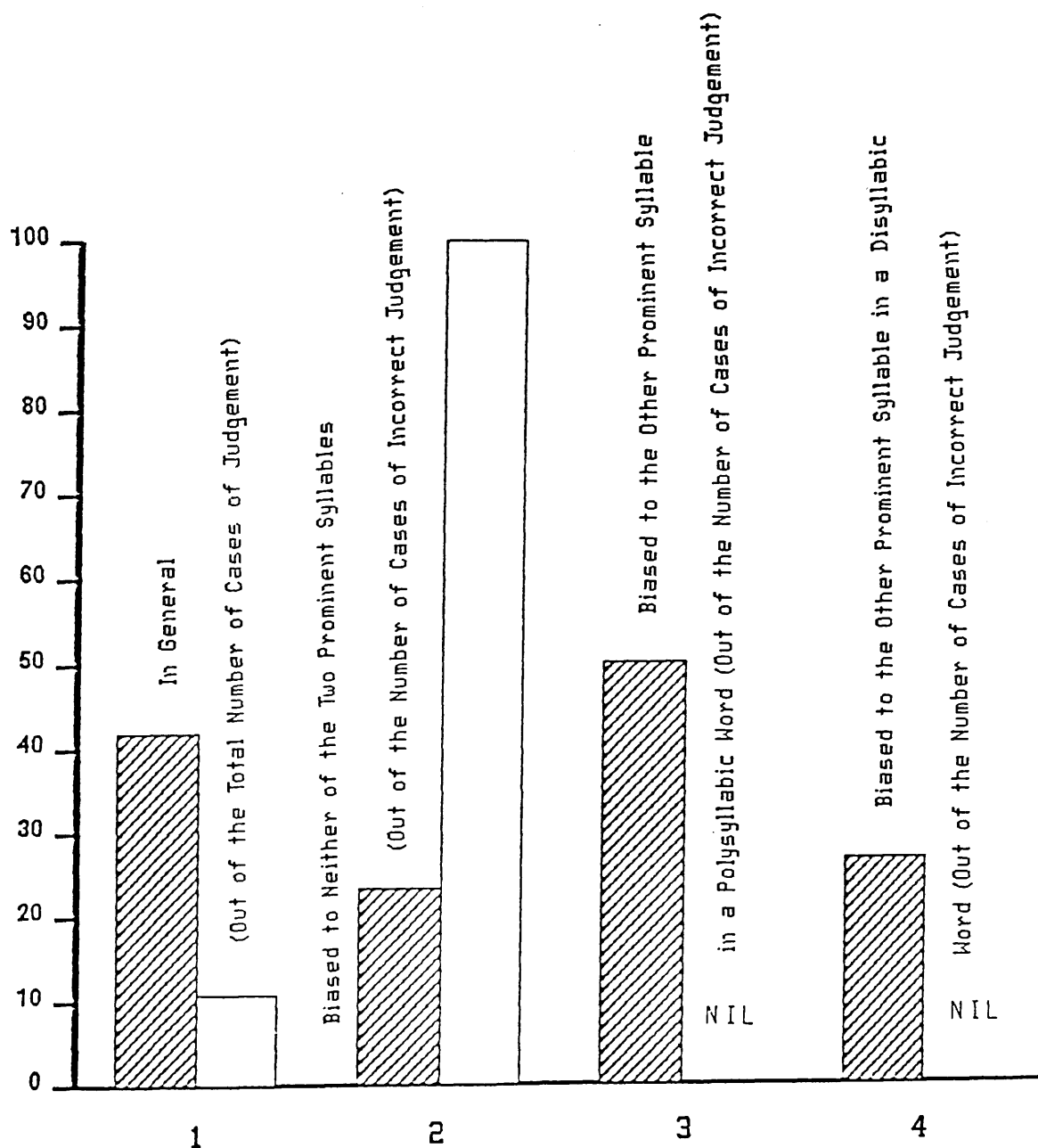


Figure P13: Percentages of incorrect judgements of the place of accent in the case of compound words by native and non-native informants.

prominent syllable in the word, but for a non-prominent syllable.

Conclusions of Chapter IV.

Part 1 of this Chapter has been devoted to reviewing the literature with regard to the inter-relations between accent and perception. This review has been divided into two Sections. Section 1 dealt with the intrinsic advantage in terms of the perceptual prominence that the accented syllables have over the unaccented ones. Since this intrinsic nature of the accented syllables has to do with their acoustic parameters, special attention has been given to the discrepancy among studies in this respect with regard to the order of importance among the physical parameters in signalling accent. This discrepancy is attributed to the possible variation in the physiological production of accent from one speech task to another, and from one speaker to another.

In this Section, moreover, several pieces of evidence have been cited to disprove the commonly held view that accent is nothing but pitch variations (cf. Bolinger 1958a). This Section has concluded with a Sub-section on the models and theories of speech perception that have confronted the problem of how accent is perceived despite the inconsistent acoustic manifestation of it. The motor theory of speech perception has been argued to be the one best suited to explain the perception of accent.

In Section 2 of Part 1 of this Chapter the effects of accent on the perception of speech have been discussed with regard to the lexical, segmental, semantic and rhythmic levels. Though several effects have been noted on these levels, circularity cannot be escaped if one is dogmatic as to whether some of these are effects

that accent causes or are caused by some related feature or features that affect accented syllables.

In Part 2, an experiment on the perception of primary tonic accent that we carried out has been described. Three Groups of informants (Group 1: Non-native speakers of English; Group 2: Native speakers of English who are phonetically naive; Group 3: Linguists) participated in the experiment where they were required to judge the place of accent in lists of individual words and a few short sentences. The aim of the experiment was mainly to test certain hypotheses with regard to the intrinsic prominence of accented syllables, rather than the effect of accent on the perception of speech. At the same time it partly aimed at testing certain hypotheses with regard to the above-mentioned classification of the judging informants, and a few others with regard to the perception of accent in given types of words.

In brief, the classification of the informants was found to be justified. Linguists were found to achieve the maximum score of correct judgements, and thus to excel the phonetically naive native informants. Non-native informants and the phonetically naive native ones were found to differ fundamentally in terms of the percentages of correct judgements they achieved and the patterns of incorrect judgements they made. The results in this respect point strongly to the advantage the native informants have over the non- native ones. This advantage is explained in the light of the motor theory of speech perception. The deviations of the scores of correct judgement and the patterns of incorrect judgement of given types of words (e.g. the deliberately misaccented words and compound words) from the general percentages and patterns are individually accounted for.

Chapter V

Conclusions

In this Chapter, we summarize the conclusions of the thesis on a Chapter-by-Chapter basis as follows:

Chapter I: Introduction.

This Chapter, apart from Section 1, laid the framework through which the experimental data included in Chapters II and III were analysed. Section 1 "Accent and the Layman" introduced the non-linguistically oriented reader to the concept of accent. It also cited studies which show that non-linguists are unconsciously aware of the location of accent when they use it in their speech and when they respond to other people's use of it.

Section 2 provided a brief survey of the use of the terms "stress" and "accent". The survey noted what can be regarded as a turning point in their use from mere synonymous terms to the restriction of the one to the abstract plane, the other to prominence in actual utterances mainly attributed to pitch change. This is shown to have become the widely held view in this respect with regard to English. Several points of criticism of this view were made.

In Section 3, we formulated an approach to accentual phenomena which integrates the word domain and the longer utterance domain in a single perspective. On this basis, we proposed an account of degrees of accent which accommodates the two domains; the dissociation of the so-called "word-accent" and "sentence-accent" was rejected. A number of related concepts like "the word in citation form" and the assumed freedom of accent in connected speech

were considered in the light of our approach.

Section 4 was an account of the various functions of accent. The role of accented syllables as attention markers for the most important items in connected speech was described. We suggested that, from the phonetic point of view, what is often described as contrast or emphasis and other semantic categories demanding an extreme type of accent should be subsumed under the label "extra-strong accent". The durational data of Test J support this distinction. An explanation was offered for the phenomenon of speech rhythm. It was argued that speech rhythm, unlike rhythm in general, is not the arrangement of movements in time, but rather the effect of the patterning of successive movements (i.e. accented and unaccented syllables) upon the perception of time. The role of the accentual patterns of words in their retrieval during speech production and identification during speech perception was also touched upon.

Section 5 was devoted to the four factors of accent (i.e. physiological stress, pitch, quality and duration); their nature, the interrelationships among them, and the role of each across the accentual hierarchy. Sub-section 5A reviewed studies of the physiology of stress and came to the conclusion that the physiological processes associated with stress are not exclusive to one peripheral system but are rather manifest on all three levels: sublaryngeal, laryngeal and supralaryngeal. This Sub-section included also a brief résumé of stress distribution which shows that the position of the stress in the word is not determined by the syntagmatic and paradigmatic structure of its syllables. Factors like the source-language of the word and the number of syllables

constituting it were found to be more effective in this respect. Sub-section 5B discussed the way pitch achieves accentual prominence. The most significant role of pitch with regard to marking tonic accent was described. The Sub-section pointed out the areas where research is wanting with regard to the relationship between Fo variation and given degrees of accent. Sub-section 5C discussed two aspects of quality (phonemic and allophonic) which are related to accentual variations. Theories explaining the neural control of vowel quality variation (i.e. the "extra energy" theory and the "undershoot" theory) were also touched upon. A given category of unaccented syllables in the EPD characterized by "full" vowel quality (e.g. the underlined syllables in PHOTOGRAPH, SPOTLIGHT) were argued to be as prominent as the EPD-marked secondary accents. It is also argued that sonority which is often associated with accent is neither an accent-determining nor an accent-determined factor. Sub-section 5D described the relationships between duration on the one hand and each of the factors of stress, pitch and quality on the other. The directly proportional relation between duration and each of those factors would seem to suggest the dependence of duration on those self-same factors. Several pieces of evidence were cited which show that accent-based durational variations are language-specific. This implies that, from the point of view of production, these variations must be independent from other factors of accent.

Chapter II: Word-Accent in the One-Word Utterance Domain.

Chapter II dealt mainly with syllable-duration as a variable that reflects the variation in the types of accent in the domain of

one-word utterances (as distinct from the domain of longer utterances). This involved comparisons of the durations of syllables with primary accent on the one hand and syllables with secondary accent on the other (Tests C and F) and of syllables with the former type of accent with others which were unaccented (Test D). Comparisons were also made between the durations of the two syllables marked with primary accents in some words in the EPD (Test B). Besides, the effect of syllable-position on syllable-duration was investigated with regard to accented syllables (Test A), to unaccented syllables (Test E), to syllables with the three types of accent, i.e. primary, secondary, and unaccented (Test F), and to syllables with primary accents and those with secondary-like accents (Test D). The consistency of the EPD marking of secondary accent was investigated through direct comparisons between syllables with secondary and secondary-like accent (Test G) and indirect comparisons between syllables with primary accent and those with secondary-like accent on the one hand and between syllables with the former type of accent and those rightly marked as unaccented in the EPD (Test D).

Syllables with primary accents were found to be mostly longer than their counterparts with secondary accents. The average margin of difference was found to be just within the threshold of perception (Test C). In similar cases of comparison with syllables with secondary accents in Compound words (Test F), syllables with primary accents were found to be longer averaging a margin of difference that was also just within the JND where syllable-position of target syllables was identical. This margin dropped to 25 msec. where it was not. Syllables with primary accents were found to be

uniformly longer than their unaccented counterparts (according to our proposed classification only) averaging a margin of difference that was almost twice as much as the JND (Test D).

In words where two syllables were marked in the EPD as receiving primary accents, tonic syllables (lexicographically) were found to be longer in one-word utterances than non-tonic syllables averaging 75 msec. Durations of vocalic nuclei of these syllables showed some degree of correlation to syllable-duration variations but they were by no means consistent as there were cases where tonic vowel nuclei were shorter than their non-tonic counterparts despite the fact that their respective syllables were longer and vice versa. In longer utterances, the number of cases where the non-tonic (lexicographically) was longer than the tonic one was comparatively greater than it was in one-word utterances. This was interpreted as lending support to the hypothesis that in utterances with contrastive contexts the durational advantage of the tonic (lexicographically) over the non-tonic could be reversed to be in favour of the latter over the former. Lexicographical non-tonics could in this case be called "contextual tonics".

No significant margins of difference were found between accented syllables occurring "earlier" in their respective words and those occurring "late" in theirs (Test A). It should be stressed that this result was derived from cases of comparison which did not include word-final syllables. The result was interpreted as replicating for English Nootboom's (1972:64-67) results for Dutch. It signifies that word-medial syllables (and not vowels as in Nootboom's study) do not show considerable durational variations compared with their word-initial or earlier word-medial counterparts.

Syllable-position as the location of a given unaccented syllable before or after the word tonic did not affect syllable-duration considerably unless post-tonic syllables were themselves word-final ones (Test E). Non-word-final post-tonic syllables were found to be longer than their pre-tonic counterparts averaging only 25msec, and there were a few adverse cases of comparison where the pre-tonic syllables were longer than their post-tonic counterparts. Where post-tonic syllables were themselves word-final ones, the average margin of difference rose to 77 msec, and there were no adverse cases of pre-tonic word-initial syllables being longer than their post-tonic word-final counterparts.

Word-final lengthening proved to be of great effect on syllable-duration in comparisons of second syllables (unaccented) and first ones (with primary accents and secondary accents) in disyllabic simple words and compound words respectively (Test F). Unaccented syllables were found to be in most cases longer than their counterparts whether they had primary or secondary accents. In compound words, the average margin in favour of word-final unaccented syllables was 89 msec and these syllables were longer in 87% of cases of comparison. Where these syllables were non-word-final, they were longer in 43% of cases only averaging, relatively, as little a margin of difference as 31 msec. In comparisons between syllables with primary accent and those with secondary accent in compound words (Test F also), syllable-position proved an important factor as the margin of difference between these two types of syllable was within the threshold of perception only where syllable-positions of target syllables were identical. Comparisons between syllables with primary accent and those with

secondary-like accent where the former were word-initial and the latter word-final showed that the final lengthening of syllables with secondary-like accent did not only reduce the durational advantage of accented syllables but it overrode it. In 27 out of 28 cases of comparison, syllables with secondary-like accent were found to be longer than their accented counterparts, averaging 117 msec.

Cases of comparison involving syllables with secondary-like accent according to our proposed classification (Tests D and G) confirmed that on the basis of duration alone this category of syllable would have been better classified if it were marked as receiving secondary accents. In Test D, the margin of difference in favour of accented syllables as compared with rightly classified unaccented syllables was 77 msec and there were no adverse cases of unaccented syllables being longer than their accented counterparts. The margin of difference in favour of accented syllables as compared with syllables we regarded as receiving secondary-like accent dropped to 49 msec and there were a few adverse cases of unaccented syllables being longer than their accented counterparts. Since the margin of difference between accented syllables and their counterparts with secondary accent was just within the threshold of perception we suggested that these results indicated a possible lack of consistency in the EPD marking of syllables with secondary accent. The same suggestion was made with regard to the results of Test G where syllables with secondary-like accents were compared directly with syllables marked as receiving secondary accents in the EPD. None of the results of this Test could be interpreted as indicating a reasonable tendency for syllables with secondary accent in the EPD to be of significantly consistent greater durations than

their counterparts with secondary-like accent.

Chapter III: Word-Accent in the Long Utterance Domain.

Chapter III dealt mainly with syllable-duration as a variable that reflects the variation in the types of accent in the domain of long utterances (as distinct from the domain of one-word utterances). This involved analysing a corpus of 50 sentences and considering the effects of apposition, of variations in speech-rate and of extra-strong accent (i.e. phenomena which are more frequently operative in the long utterance domain) on this variable. Besides, a comparison between the effects of the two domains of one-word utterances, on the one hand, and of longer utterances, on the other, on the above mentioned variable was also carried out.

As in one-word utterances, syllables with primary accent were found to be on average longer than unaccented syllables. Syllables with primary tonic accent had a greater margin of difference over their unaccented counterparts than that which syllables with primary non-tonic accent had over theirs (Test DU). Syllables with secondary accent were found to be, in turn, shorter than their counterparts with primary accent (Test CU).

The foregoing results apply to cases of comparison where the syllables compared are of identical paradigmatic and syntagmatic structure. Similar results have been obtained through a syllable-by-syllable analysis of the corpus of 50 sentences where the condition of identity in paradigmatic and syntagmatic structure had, obviously, to be abandoned (Test L).

The syllables we have described as receiving secondary-like

accent were found in all the Tests that consider them (Tests CU, I, and L) to produce more favourable results to the central contention of the thesis (i.e. that syllable-duration variation is in a direct relation with the type of accent a syllable receives across the accentual hierarchy) if they are classified with the syllables with secondary accent rather than with unaccented ones as is done in the EPD.

The effect of syllable-position(= the occurrence before or after the word-tonic syllable)on syllable-duration was investigated with regard to unaccented syllables. This factor was found to be significant only where the post-tonic syllables were themselves word-final ones and their pre-tonic counterparts *were* word-initial ones (Test EU). The relation between syllable-duration and apposition was also investigated (Test H). All the informants were consistent in keeping an average margin of difference between syllables in appositional phrases on the one hand and the sentences containing them on the other. Moreover, the margins of difference were consistently in favour of the appositional phrases. This was interpreted as an indication that the prominence of appositional phrases is partly achieved by way of decrease in the speech-rate. The word "partly" is used in this context to allow for the fact that though the margins were consistently in favour of the appositional phrases they never amounted to the JND. In search for an alternative explanation, pausing at the boundaries of appositional phrases was also considered. This factor was, similarly, found to offer only a partial explanation for the prominence of appositional phrases since it did not occur at all boundaries of appositional phrases and the durations of pauses were not uniformly within the

JND. Pitch change was found to be another factor that only partially contributed to the prominence of appositional phrases.

Margins of durational difference have been found to exist also between the various types of accent in faster speech-rates (i.e. between syllables with primary accent and those with secondary accent, and between the latter and unaccented syllables). No evidence, though, has been found to suggest that the durationally compressive effect in faster speech-rates is achieved mostly at the expense of unaccented syllables. In fact, a slight tendency to the contrary (i.e. to achieve the compressive effect more at the expense of accented syllables) has been noted (Test I).

In its relation to duration, "extra-strong accent", a type of accent under which is subsumed what is commonly known as "contrastive accent", has been found to rank top of the accentual hierarchy. An average margin of difference of 80 msec has been found to exist between syllables that received a shifted accent and tokens of the same syllables when they were unaccented. This is a big margin of difference in view of the fact that the syllables normally accented (i.e. that received tonic accents which were neither shifted nor contrastive) were longer than their unaccented counterparts by only 49 msec in Test D (Test J).

The approach of this thesis with regard to the classification of the types of accent has been one that does not distinguish between the domains of the so-called "word-accent" and "sentence-accent". The approach is compatible in this respect with that of Chomsky and Halle (1968:25-26). Their approach has been described by Schmerling (1976:7) in these words:

"Chomsky and Halle's claim is that sentence stress is (almost) entirely predictable from the stress of individual words and the hierarchical organization of the utterance at the level of the input to the phonology...."

The empirical plausibility of this approach was investigated through syllable-to-syllable and word-to-word durational comparisons of tokens of words in one-word utterances and their counterparts in longer utterances. Syllable-to-syllable comparisons were found to be either insignificant or, when considerable, to be attributable to factors other than the change of the domain of the utterance from that of the one-word to that of the longer utterance. Besides, word-to-word comparisons have shown that considerable two-way variations (i.e. that some syllables in the one-word token are jointly considerably longer than their longer utterance counterparts, while the rest are jointly considerably shorter) form too small a percentage of the cases of comparison to support the plausibility of the dissociation of so-called word-accent and sentence accent.

Chapter IV: Accent and Perception

Accent has been studied from the point of view of perception in Chapter IV. That Chapter is divided into two parts:

Part 1: Literature Review.

Part 1 constitutes a literature review which is divided, in turn, into two Sections:

(i) The way accent itself is perceived. The review in that Section made clear that during the perception of an utterance, its

accentual patterns would be likely to be processed prior to its ultimate recognition. This can be countenanced only if the process of perception is an ongoing process during which preliminary hypotheses based on the acoustic spectra of subsequent chunks of the utterance are continually offered and modified till final decisions (reconciling the phonetic, phonological, syntactic, semantic, hypotheses) are made. Cooper and Fowler (1984), for instance, find some evidence that in the course of identifying words from the speech continua, the prosodic structure of an utterance, including its accentual patterns, is automatically taken into account, but not so its semantic content. The prosodic structure of the utterance is manifested by its physical parameters. As far as accent alone is concerned, different studies have been found to report different hierarchies of the order of importance of the physical parameters. Examples of these paradoxically conflicting studies are cited. Apart from this discrepancy, there is that extreme, yet commonly held, view that accent is no more than pitch changes.

The discrepancy as to the order of importance of the physical parameters as reflections of accent was ascribed to the lack of constancy in the behaviour of the physiological mechanisms involved and in the speech task carried out. Several pieces of evidence have been cited which undermine the commonly held view that accent is but pitch change (cf. Bolinger 1958a). A more plausible approach, it was argued, is one that ascribes the perceptual prominence of accented syllables to multi-factorial combinations of the psychophysical dimensions of syllables (cf. Beckman 1986).

Models and theories of speech perception attempting to explain how accent is perceived despite the problems posed by its acoustics

were also touched upon. It was argued that the motor theory of speech perception accounts well for the perception of accent. According to the theory, the acoustic manifestations of accent, though inconsistent, evoke in the mind of the listener the sensory effects of the articulatory movements (sublaryngeal, laryngeal and supralaryngeal) s/he uses in the production of accent. See below for an account of some of the pieces of evidence derived from our perceptual experiment supporting the theory.

(iii) The effect of accent on the perception of speech

The review in this section has shown that accent, through the alternation of accented and unaccented syllables, helps in identifying the words in longer stretches of speech since the accentual patterns of words are supposed to be part of their representation in the mental lexicon. The perception of segments in speech is also found to be partly dependent on whether they occur in accented or unaccented syllables. The information structure of a given context (i.e. the given/new dichotomy) is found to be best signalled to the listener when it is marked by appropriate phonetic accentuation. The rhythm of the alternation of accented and unaccented syllables has been found to form the sturdy framework of the speech signal that defies the distortion or inaudibility that sometimes obscures individual segments. It also induces auditory anticipation that creates linguistic coherence.

Part 2: The perception Test

Several conclusions can be inferred from the results of the Test as follows:

(1) Familiarity with linguistic concepts gave an advantage for the linguists over the laymen in judging the place of the primary

tonic accent.

(2) There was an advantage for native speakers of English (who are phonetically naive) over non-native ones. This advantage was in terms of the percentages of correct judgements. This is in perfect compliance with the motor theory of speech perception with respect to the perception of accent.

(3) The patterns of incorrect judgements of the place of accent proved different for native and non-native informants. Non-native informants had a greater tendency to opt for another prominent syllable in the word, whereas native informants had a greater tendency to opt for an adjacent non-prominent syllable. This has been interpreted as an added advantage for native informants (besides that described in (2) above) since the latter pattern has been assumed to be the nearest thing to a correct judgement.

(4) Another piece of evidence supporting the motor theory of speech perception with respect to the perception of accent comes from the fact that the incorrect judgement of the place of accent (see Sub-test 1) has been found to be predominantly production-biased. That is, non-native informants tended to judge as accented the syllables they themselves pronounced as accented and vice versa.

(5) The pattern of judgement of the place of accent in words with deliberately misplaced accent (with the result of having two prominent syllables in the word: the one that receives the misplaced accent, and the one that is normally accented) has been found to be somewhat different from that of properly accented words with two prominent syllables. This difference applies to the judgements of native informants only. In the case of these informants, over half

of the incorrect judgements were the result of confusing the accented syllables with non-prominent ones. In the case of non-native informants over half were the result of confusing the accented syllables with lexicographically accented ones. Besides, the overall percentage of incorrect judgements was not much raised (as one would expect it to be if it were to be in line with the result just stated) in the former case over that in the latter.

These two results, though paradoxically contradictory, both support the motor theory of speech perception with respect to the perception of accent. The fact that there is a difference in the pattern of judgement between the two cases suggests that in words with deliberately misplaced accents, the judgement of the native informants is partly biased for the syllables that in their mental lexicon normally receive the accents. The fact that the overall percentage is not much raised in the former case over that in the latter suggests that the deviation from the norm of pronunciation for such words with deliberately misplaced accent may in itself induce correct judgement. This is to say that the motor theory of speech perception accounts for some incorrect judgements directly (i.e. causing a bias for lexically accented syllables) and for some correct judgements indirectly (i.e. inciting them through the deviation from normal pronunciation).

(6) The contrastive context, rather than no context at all, has been found to induce higher percentages of correct judgement for the place of shifted accents (compare the results in Sub-test 3 with those in Sub-test 4). This is not peculiar to native informants only but extends to non-native ones as well.

(7) There was no evidence to suggest that the EPD-marked common

variants (of words with two variants where both are included in the Test material - see the results for Sub-test 5) were more frequently correctly judged than were the less common ones. In fact judging the place of accent in this type of word was found to be similar to that of words with two prominent syllables in general (see Sub-test 2). This was true both in terms of the magnitude of the percentages of correct judgement and of differences in the patterns of incorrect judgement between native and non-native informants.

(8) No evidence was found to support the hypothesis that the heavier an accented syllable was (in terms of its syntagmatic structure) the more often it would be correctly judged as accented (see Sub-test 6).

(9) Results with regard to judgements of the place of the primary tonic accent in root-related words (Sub-test 7) proved unsystematic in that they did not categorically support the one hypothesis or the other, but rather some of the implications of both hypotheses underlying that Sub-test. Besides, they partly contradicted the tendency that was found to characterize the judgements of the non-native informants (i.e. the tendency to confuse the accented syllable for another prominent syllable in the word). The occurrence of a root-related word earlier in the list of test-words affected to some extent the judgement by native informants of the place of tonic accent in the second word of each pair (causing a rise in the percentage of incorrect judgements - out of the total number of cases of incorrect judgements - due to confusing the accented syllable in the target word for the one accented in the word occurring earlier - if compared with the opposite percentage for Type A words in Sub-test 2). This rise

could only be interpreted as the result of a bias of internalized grammar through which the accented syllable in a root-related word that had just been evoked from the mental lexicon would be wrongly judged to be accented.

Out of the total number of incorrect judgements by non-native informants, there was a remarkable drop in the percentage of cases due to confusing the accented syllable in the target word with that accented in the root-related word occurring earlier. Though this drop enforces the explanation given above about the effect of internalized grammar biases which would be characteristic of the judgements of native informants only, it is not clear why the non-native informants did not maintain their tendency to confuse the accented syllable with another prominent syllable more often than they would confuse the accented syllable with a non-prominent syllable in the word. There is, then, no apparent explanation why this tendency was reversed in this type of words only. For once, the nature of the task overrode the advantage the native informants would theoretically be assumed to have in terms of the patterns of incorrect judgement they would be likely to make. However, they maintained a comparable margin of difference (to that with regard to type A words in Sub-test 2) over non-native informants in terms of the percentage of correct judgement as would be partly predicted by the theory.

(10) The judgement of the place of the tonic accent in compound words with two prominent syllables proved particularly difficult for non-native informants. 76.7% of their incorrect judgements were found to be due to confusing the accented syllable with the syllable with secondary accent (compared with 62.9% for type A words in

Sub-test 2). Contrarily, the judgement of the place of the tonic accent by native informants in this particular type of word proved to be an easier task. Out of the total number of cases of judgement, they made incorrect judgements in only 10.7% of cases; and in no single case was the incorrect judgement due to confusing the accented syllable with the syllable with secondary accent.



THE NATURE OF WORD-ACCENT IN ENGLISH
WITH SPECIAL REFERENCE
TO DURATION AND PERCEPTION

by

MOUSTAFA AHMED MOUSTAFA GOMAA

VOLUME 2

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to

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Department of English Language
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APPENDICES

APPENDIX 1.

INSTRUCTIONS TO THE RECORDING INFORMANTS

The aim of the experiment you have kindly agreed to participate in is to study a particular aspect of English pronunciation.

The enclosed list of words and sentences and this set of instructions have been given to you in order to allow you time to become familiar with the list and to know what you will be asked to do.

Your part in the experiment is simply to record the enclosed list in the recording studio (Audio-Visual Centre, Southpark Avenue)

You are required to choose the level of loudness and the speed of delivery that suit you and to try to stick to them as far as possible throughout the recording.

The material to be recorded varies from words to sentences. The words are presented in the form of two words per line. Apart from reasons of space, there is no significance whatsoever in the way they have been set out.

Each word should be approached afresh. One way to maintain this attitude is to imagine before each word that someone is asking you the question: "What word did you use?" If after recording a particular word you feel you are not satisfied with the way you said it, you can say it again. You can always go back to words without having to stick to the order they are set out in. The same applies to sentences: if in the middle of a sentence you feel for example you have paused too long, or are out of breath, or you are simply not happy with it, you can always say it again.

The pauses between utterances do not have to be the same, so have a rest when you feel you need to in order to ensure that you are always at ease when you are speaking.

APPENDIX 2.

THE MATERIAL RECORDED FOR ANALYSIS.

pencil	sacrifice
uncomfortable	return
machinegun	discredit

- I don't mean you should stand up.
- The imperceptibility of such things is quite understandable.
- Pensions are to be cut at the stroke of a pen.

dependence	internal
non-stop	London
defending	specification
militant	artist
theoretical	mealtime

- We took a taxi but the cabman didn't know where the place was.
- Transoceanic signals can now be easily intercepted.
- The frequent political rather than social upheavals don't augur well for the country's future welfare.

turntable	interdepend
resuscitate	Campbell
understandable	specify
persevere	tending
electrochemistry	ransack

- Pass me your pencil.
- It's a permanent rather than a temporary filter that we want.
- Stand up when the teacher comes in.

pensioner	unpatriotic
calcium	gustation

fundamental	renders
piecemeal	stopwatch
account	photographic

- Chemistry and electrochemistry books are on the same shelf.
- "Misunderstand" is a word he's always using.
- His astonishingly upright manners made us tolerate some mistakes on the part of his people.

interdependence	stand up
taxicab	cummerbund
sending	category
filtration	mental
capsize	window

- Once you fulfil these expectations, you're sure to find some others will arise.
- Hopefully nobody'll misunderstand what we're trying to do.
- He drove non-stop to the police station.

nettlerash	withstanding
combination	personal
genders	catastrophic
schoolgirl	fairly
avoid	(v) refund

- Pencils are things you need for the exams.
- Powerful rather than weak gustation is a characteristic of such animals.
- Mr. Thompson, my maths teacher, answered all my questions satisfactorily.

bending	fundament
mortification	combat

cageling

artificiality

whereby

deadlock

upmost

Calcutta

- Writing with pencils only is not recommended in exams.
- I didn't say it's comfortable; I said it's uncomfortable.
- Many people say that London is far and away more beautiful than Paris.

headache

production

mentality

curator

penny

sarcastic

fulfil

millionairess

- Some people think he's happy. Conversely, others disagree completely with this assessment.
- He shouldn't keep on saying the word "misunderstand".
- I do know that this machine's due back in a week's time.

sizeability

pressure

watchful

pentameter

mouth-organ

aching

product

rumptitum

photograph

vary

- Put the three words: "cotton, barley, sugar" in sentences of your own.
- The victims of the fire, half of them children, have at last been identified.
- As we already know, the process of filtration is far from adequate.

underwear

harmful

outsizes

sarcasm

dayschool

accountability

architect

standstill

hermetic

captain

- I wonder if we're going to have to stand up all afternoon.
- I have the feeling that his versification is at its best when it deals with nature.
- It was automatic rather than such old-fashioned machineguns we wanted to get hold of.

militarization

lending

cabman

full-length

specify

mediate

avoidability

typist

fullness

letter-balance

- In the middle of the wash, the washing machine broke down.
- A person with a really severe defective mentality should be considered separately from the others.
- We'd better put this particular portrait in the lounge.

girlhood

land-owner

get-up

airport

typographic

household

rumbustious

organ

barley-sugar

polite

- I hate sending letters to people who wouldn't bother to reply.
- The conference, the one in London, is believed to have come to some significant conclusions.
- He designed the sports car whereby he won the race.

fundamental

sending

curate

powerhouse

Miltonic	boyhood
variability	postal
cow-boy	mediation

- The three rather than the two categories of study show signs of overlapping.
- You'll need a special pencil besides the pen.
- I did resuscitate the patient immediately before the injection.

thoroughfare	portrait
avalanche	Lochleven
pentecostal	shooter
conversely	runner-up
Easter	footballer

- Cotton rather than synthetic underwear is good for the skin.
- Lochnagar and Lochleven are both Scottish place names.
- The child's mental progress is largely affected by environmental circumstances.

totality	universe
schoolboy	theory
mediate	goalpost
foundation	missile
Easterday	balance

- High blood-pressure may be caused by excess of salt intake.
- Total dependence on foreign countries threatens our independence.
- Put these three words "tenancy, market, garden" into sentences of your own.

pea-shooter	compound
divert	(adj.) august

mortify	coca-cola
matrimonial	mending
penny-royal	runner

- It's only some newscasters who present the news in a lively manner.
- It's fair to say that the airport'll be economically good for the area, but it'll also be an environmental nuisance.
- All drugs are certainly harmful in a direct or indirect way.

door-mat	Newtonian
spending	rent-free
communicate	window
ball-bearing	cotton
exploitation	caster

- Definitely all new-fashioned songs are better seen than listened to!
- Put the three words "picture, gallery, hunter" into sentences of your own.

landlord	educate
corridor	life-tenancy
aorta	(v) conduct
market-garden	consultation
separate	daylight-saving

- It was shocking to find myself at mealtime the only person at the table.
- He proved long ago that this concept was faulty.
- The note he left doesn't clearly specify where he was heading.
- It was an unusually dark night.
- He persevered relentlessly in order to retain his title.

- Only limited spending can be countenanced at the present time.
- You'd better return the tape-recorder and bring the turntable.
- His characteristically sarcastic impressions always fascinate the audience.

life-rent

pronunciation

comprehend

constructive

harmless

fool-proof

- Recently, catastrophic volcanoes and earthquakes have shown how helpless humanity is at the hands of nature.
- If you unload the truck piecemeal tonight, we can start building tomorrow.
- The actual range of specifications is to be modified on all future models.
- But you intended to go there anyway.
- She's really the artist you're looking for.
- How did you manage to do that?
- It was the rent I argued with the landlord about.
- The fundamentals of religious belief can't be subjected to empirical research.
- It's the black homelands that are clearly being discriminated against.
- I simply don't know what to do.

communication

blending

picture-gallery

reprehend

sentiment

hot-pot

minuting

dimensions

- It's the underdogs, not the defending champions, who are usually under pressure.

- We'll combat terrorism in whatever form it takes.
- You can't expect me to hold your hand.
- It was his characteristic sarcasm that concealed his underlying seriousness.
- A harmonious bouquet of artificial flowers will make a pleasant gift.
- Why on earth did you want to do that?
- We can't proceed without having to go into some appalling personal details.
- I said keeper, not deeper.
- The avalanche you're talking about was mentioned in the paper yesterday.
- Put the three words: "exercise, body, snatcher" into sentences of your own.

coca	multidimensional
sentimentally	co-exist
mimicry	silica

- The architect who was acting as a guide accompanied us right round the building.
- It wasn't so much the pronunciation as the spelling of "rumptitum" that he found a bit unusual.
- It's the Miltonic style, not the vocabulary, you should pay attention to in "Paradise Lost".
- I wondered if you'd like some of these.
- The cobbler never got round to mending the shoes; he was busy mending boots.
- Production was brought to a calamitous standstill during the strike.

- I did get up early and yet I missed it.
- Andrew was quite sure he'd lost it.
- It's the government that are feeling the pressure at the moment.
- That huge cotton-wool packet lasted for at least three months.

mini	product
technician	lion-hunter
pedestrian	detective

- Sports competitions had at first a religious orientation.
- I saw him with the mouth-organ in his pocket only five minutes ago.
- The poem doesn't have the regular pentameter rhythm you might expect.
- It has a lot to do with Newtonian Laws of Gravity.
- The bony fundaments of the severely malnourished children looked almost like skeletons.
- The old rumbustious lion has at last met its match.
- She was stunned at becoming a millionairess overnight.
- Their socialism was a combination of nationalism and republicanism.
- Not one but two organ players have joined the band.
- The bigger castors proved more practical than the smaller ones.

fantasia	Sicily
R.A.F.	creator
Piccadilly	creeper

- The unwarranted lending to overseas countries is getting more and more risky.
- It was so august an occasion that I forgot the errand I had to run.

- They're administrative difficulties in the first place.
- I did try the corridor to the left.
- Not all genders are so easy to account for.
- All of us were surprised to hear that you'd gone.
- He claimed the argument was constructive, not destructive.
- I said harmless, not harmful.
- They only want to export to us, not to import from us as well.
- I said comprehend, not reprehend.
- This whisky wasn't imported from Ireland, it was deported.

I. PLEASE SAY THE FOLLOWING SENTENCES FIRST AT YOUR NORMAL RATE OF SPEAKING, THEN AT A FASTER RATE:

- A hot-pot is quite enough for my lunch.
- He still doubts the fool-proof evidence they produced.
- The process of filtration didn't actually fulfil the expectations of the manufacturer.
- The title is: "Dimensions of Mentality and Social Adaptation".
- They'll conduct an investigation on products with artificial colouring.
- It proved catastrophic not to include all categories in the study.

Cambodia

misunderstand

rational

birdcage

Appendix 3.

Questionnaire

Dear Participant

The following questionnaire aims at getting information that could be of relevance to the purposes of the experiment on English pronunciation you kindly participated in. The information you give will be kept in strict confidence, and no personal reference with regard to this information will be made in the thesis.

1. Name:
2. Place of Birth:
3. Age on 6th Dec. 1985:
4. Where did you have your Primary and Secondary education?
5. What sort of schools (e.g. public school) did you have your primary and secondary education in?
6. Where did you have your undergraduate/postgraduate university education?
7. State the counties where you have had jobs and settled down in for any significant length of time. Roughly how long did you spend in each county?
8. Which accent of English would you say you speak?

Appendix 4

Instructions to Judging Informants

The aim of the experiment you have kindly agreed to participate in is to study a certain aspect of English pronunciation. You will hear a recorded audio tape. The recorded material consists mostly of lists of words; only a few short sentences are included.

The recorded material is written down in this test paper in the same order in which you will hear the items. Each word (or target words in a sentence) is re-typed in such a way as to show its component parts. Sometimes a more phonetic spelling is used to help you.

You will hear each word twice. After listening to the pronunciation please underline the part you perceive as most prominent or loudest or the one you feel stands out from the rest. Notice, for example, how the prominent part varies in the opening three words on the tape.

Appendix 5

Perception Test Material

photograph	pho to graph
photography	pho to gra phy
photographic	pho to gra phic

.....

temporary	tem po ra ry
exercise	ek ser cise
mentality	men ta li ty
pelican	pe li can
coca-cola	co ca co la
category	ca te gory

.....

sentiment	sen ti ment
artificial	ar ti fi cial
adult	a dult
diminish	di mi nish
interdepend	in ter de pend
triumphant	tri um phant

.....

concept	con cept
catastrophic	ca ta stro phic
Essex	E ssex
letter-balance	le tter ba lance
necessary	ne ce ssa ry
matrimonial	ma tri mo nial

.....

dimension	di men sion
compliment	com pli ment
silica	si li ca
substantiation	sub stan ti a tion
multiply	mul ti ply
Preston	pre ston

.....

gelatine	ge la tine
Hogmanay	Hog ma nay
taxicab	tak si cab
airport	airport
testimony	te sti mo ny
stopwatch	stop watch
adult	a dult
terrestrial	te rre stri al
adequate	a de quate

.....

incense	in cense
ransack	ran sack
characteristically	cha rac te ri sti ca lly
conversely	con verse ly
mathematics	ma the ma tics
missile	mi ssile

.....

consultation	con sul ta tion
sacrifice	sa cri fice
countenanced	coun te nanced
evident	e vi dent

sentimentally

sen ti men ta lly

amateur

a ma teur

.....

substantial

sub stan tial

estimate

e sti mate

runner up

ru nner up

habitat

ha bi tat

conversely

con verse ly

separate

se pa rate

.....

gelatine

ge la tine

mealtime

meal time

pesticide

pe sti cide

direct

di rect

persevere

per se vere

amateur

a ma teur

.....

benefaction

be ne fac tion

account

a ccount

Sicily

Si ci ly

compost

com post

pentameter

pen ta me ter

incense

in cense

.....

signify

sig ni fy

combat

com bat

present

pre sent

benefaction

be ne fac tion

essay

e ssay

.....

evidential

e vi den tial

mouth-organ

mouth or gan

premature

pre ma ture

relentlessly

re lent less ly

understand

un der stand

compliment

com pli ment

capsize

cap size

escort

e scort

.....

premature

pre ma ture

Easter-Day

Ea ster Day

process

pro cess

educate

ed yu cate

Prestwick

Prest wick

necessitate

ne ce ssi tate

.....

significance

sig ni fi cance

resuscitate

re su sci tate

Hogmanay

Hog ma nay

multiplicity

mul ti pli ci ty

goalpost

goal post

accusation

a ccu sa tion

.....

I said HARMFUL not HARMLESS

harm ful harm less

I said COMPREHEND not REPREHEND

com pre hend re pre hend

It was IMPORTED not DEPORTED

im por ted de por ted

Appendix 6

Perception Test Material with Required Manipulations (as Presented to the Recording Informant).

photograph

photography

photographic

temporary

exercise

mentality /[^]mentælətɪ/

pelican

coca-cola /₁kəʊkə[^]kəʊlə/

category

sentiment

artificial

adult

diminish

interdepend /[^]ɪntədɪpend/

triumphant

concept

catastrophic /kə[^]tæstrɒfɪk/

Essex

letter-balance /[^]letə₁bæləns/

necessary /[^]nesəsəri/

matrimonial /[^]mætrɪ₁məʊnjəl/

dimension	/daɪˈmenʃn/
compliment	/ˈkɒmplɪment/
silica	/ˈsɪlɪkə/
substantiation	
multiply	
Preston	

gelatine	/ˈdʒelətiːn/
Hogmanay	/ˈhɒgməneɪ/
taxicab	
airport	/eəˈpɔːt/
testimony	
stopwatch	/ˈstɒpwɒtʃ/
adult	/ˈædʌlt/
terrestrial	
adequate	

incense	/ˈɪnsens/
ransack	
characteristically	
conversely	/ˌkɒnˈvɜːslɪ/
mathematics	
missile	

consultation	/kɒnˈsʌlteɪʃn/
sacrifice	
countenanced	
evident	

sentimentally

amateur / ˌæməˈtɜː /

substantial

estimate / ˈestɪmət /

runner up / ˌrʌnər ˈʌp /

habitat / ˈhæbɪtæt /

conversely / ˈkɒnvɜːslɪ /

separate / ˈseperət /

gelatine / ˌdʒeləˈtiːn /

mealtime

pesticide

direct / daɪˈrekt /

persevere / ˈpɜːsɪvɪə /

amateur / ˈæmətɜː /

benefaction / ˈbenɪfækʃn /

account

Sicily / ˈsɪsɪli /

compost / kɒmˈpɒst /

pentameter

incense / ɪnˈsens /

signify

combat / ˈkɒmbæt /

present / prɪˈzent /

benefaction / ˌbenɪfækʃn /

essay

evidential

mouth-organ

premature /[^]premə₁tʃvə/

relentlessly

understand /[^]ʌndə₁stænd/

compliment /₁kɒmplɪ[^]ment/

capsize /[^]kæpsaɪz/

escort /[^]eskɔ:t/

premature /₁premə[^]tɪvə/

Easter-Day /₁i:stə[^]deɪ/

process /[^]prəʊses/

educate

Prestwick

necessitate

significance

resuscitate

Hogmanay /₁hɒgmə[^]neɪ/

multiplicity

goalpost /[^]gəʊlpəʊst/

accusation /ə[^]kju:zeɪʃn/

I said HARMFUL not HARMLESS

/ha:m[^]fʊl/, /ha:m[^]les/

I said COMPREHEND not REPREHEND

/[^]kɒmprihend/, /[^]reprihend/

It was IMPORTED not DEPORTED

/[^]ɪmpɔ:tɪd/, /[^]di:pɔ:tɪd/

APPENDIX Ai

Durations in msecs of accented syllables with identical order in their respective words.

WORD	S1	S2	S3	S4	WORD	S1	S2	S3	S4
TYPOGRAPHIC	183	187	172	162	PHOTOGRAPHIC	184	189	198	127
PENTAMETER	164	174	163	148	MENTALITY	203	205	158	169
MENTALITY	203	205	158	169	TOTALITY	269	180	194	152
PENCIL *	165	147	180	195	PENSIONER *	142	135	142	126
HARMFUL	281	266	236	283	HARMLESS	355	360	294	227
VERSIFICATION	215	200	190	198	MORTIFICATION	184	202	208	181
STANDSTILL	440	316	371	376	STAND UP	429	322	350	386
SCHOOL-BOY	448	326	331	367	SCHOOL-GIRL	378	341	325	300
MILITANT	154	100	108	93	MINUTING	204	129	144	90
ARCHITECT	150	95	105	107	ARTIST	170	156	131	142
MIMICRY	228	94	104	130	MINI	204	163	127	95
COMPREHEND	465	330	360	328	REPREHEND	571	168	382	305
SENDING	262	265	221	236	SENTIMENT	249	184	234	163
SICILY	298	109	140	135	SILICA	273	211	150	139

NB. Values of target syllables in words marked with * do not include the duration of the closure phase of a plosive.

Appendix Aii

Durations in msecs of accented syllables with different order in
their respective words

Word	S1	S2	S3	S4	Word	S1	S2	S3	S4
DE <u>PEN</u> DENCE	242	239	244	193	INTERDE <u>PEN</u> DENCE	238	215	212	210
WITH <u>STAN</u> DING	336	375	266	358	UNDER <u>STAN</u> DABLE	290	260	261	291
ME <u>N</u> TAL	278	182	206	161	FUNDAMENT <u>A</u> L	168	153	163	192
SIZEAB <u>I</u> LITY	123	92	97	67	AVOIDAB <u>I</u> LITY	83	88	123	91
AVALANC <u>H</u> E	120	88	81	78	ARTIFICIAL <u>I</u> LITY	127	93	106	85
DIMEN <u>S</u> IONS	206	196	168	157	SENTIMENT <u>A</u> LLY	202	176	180	119
FANTAS <u>I</u> A	317	231	234	203	CONSULT <u>A</u> TION	221	197	159	219
SENTIMENT <u>A</u> LLY	202	176	180	119	MULTIDIMEN <u>S</u> IONAL	187	165	177	157
ACH <u>I</u> NG	142	63	97	105	PRONUNCI <u>A</u> TION	165	172	150	14
MEDIAT <u>I</u> ON	197	140	151	170	PRONUNCI <u>A</u> TION	165	172	150	148
GUSTAT <u>I</u> ON	202	140	195	181	CONSULT <u>A</u> TION	221	197	159	219

Appendix Bi

Syllable and vowel durations of tonics and non-tonics in one-word utterances.

Word	non-tonic lexicographically							
	S1		S2		S3		S4	
	syll	vowel	syll	vowel	syll	vowel	syll	vowel
<u>NON-STOP</u>	225	99	230	54	188	76	228	84
<u>UNCOMFORTABLE</u>	163	91	113	65	104	52	114	72
<u>ELECTROCHEMISTRY</u>	165	69	138	73	135	46	153	67
<u>UNPATRIOTIC</u>	137	64	127	82	134	69	137	90
<u>DISCREDIT</u>	200	84	127	73	124	39	162	31
<u>CO-EXIST</u>	187	101	126	84	128	76	118	69
<u>MULTIDIMENSIONAL</u>	163	91	117	43	170	75	157	32

Word	tonic lexicographically							
	S1		S2		S3		S4	
	syll	vowel	syll	vowel	syll	vowel	syll	vowel
<u>NON-STOP</u>	358	142	305	114	329	99	306	94
<u>UNCOMFORTABLE</u>	253	69	201	71	212	52	226	64
<u>ELECTROCHEMISTRY</u>	222	73	136	69	163	37	139	39
<u>UNPATRIOTIC</u>	105	105	48	48	99	99	54	54
<u>DISCREDIT</u>	194	106	211	73	156	69	196	57
<u>CO-EXIST</u>	430	118	427	110	337	138	313	90
<u>MULTIDIMENSIONAL</u>	188	67	160	52	177	53	157	67

Appendix Bii

Syllable and vowel durations of tonics and non-tonics in longer utterances.

Word	non-tonic (lexicog.)							
	S1		S2		S3		S4	
	syll.	vowel	syll.	vowel	syll.	vowel	syll.	vowel
<u>NON-STOP</u>	218	88	198	75	244	82	233	84
<u>UNCOMFORTABLE</u>	149	82	152	64	130	65	171	75
<u>ELECTROCHEMISTRY</u>	158	58	170	69	115	45	149	67
<u>IMPERCEPTIBILITY</u>	146	88	123	73	106	61	97	52

	tonic (lexicog.)							
	S1		S2		S3		S4	
	syll.	vowel	syll.	vowel	syll.	vowel	syll.	vowel
<u>NON-STOP</u>	350	112	282	93	246	78	281	84
<u>UNCOMFORTABLE</u>	196	46	180	46	194	71	173	37
<u>ELECTROCHEMISTRY</u>	157	58	115	52	116	30	102	20
<u>IMPERCEPTIBILITY</u>	88	45	73	42	86	43	99	52

Appendix C

Durations in msec of syllables with primary and secondary accent

Word	S1	S2	S3	S4	Word	S1	S2	S3	S4
<u>SPECIFY</u>	167	182	230	222	<u>SPECIFICATION</u>	145	170	146	201
<u>MILITANT</u>	154	100	108	93	<u>MILITARIZATION</u>	106	62	69	86
<u>CATEGORY *</u>	133	97	131	115	<u>CATASTROPHIC *</u>	86	94	89	102
<u>FUNDAMENT</u>	187	131	140	187	<u>FUNDAMENTAL</u>	139	169	116	186
<u>COMBAT</u>	202	145	194	154	<u>COMBINATION *</u>	147	146	129	128
<u>FULLNESS</u>	179	192	196	194	<u>FULL-LENGTH</u>	233	152	208	239
<u>MEDIATE</u>	181	133	132	127	<u>MEDIATION</u>	154	117	83	145
<u>COMMUNICATE</u>	172	97	108	121	<u>COMMUNICATION</u>	124	63	83	74
<u>MORTIFY</u>	199	142	136	130	<u>MORTIFICATION</u>	164	128	99	107
<u>PERSONAL *</u>	141	135	145	123	<u>PERSEVERE *</u>	128	97	150	119
<u>ARTIST</u>	170	156	131	142	<u>ARTIFICIALITY</u>	120	99	84	105
<u>TYPIST *</u>	170	131	146	155	<u>TYPOGRAPHIC *</u>	145	103	108	124
<u>PHOTOGRAPH</u>	170	96	91	97	<u>PHOTOGRAPHIC</u>	114	105	79	86
<u>VARY</u>	171	289	232	228	<u>VARIABILITY</u>	260	73	144	136
<u>CURATE *</u>	225	189	156	223	<u>CURATOR *</u>	198	111	97	168

NB. Durations of target syllables in words marked with * do not include the duration of the closure phase of a plosive.

Appendix Di

Durations in msec of accented syllables and their unaccented counterparts

Word	S1	S2	S3	S4	Word	S1	S2	S3	S4
<u>INTERDEPEND</u>	117	98	98	112	<u>PENTAMETER</u>	174	174	172	159
<u>CATASTROPHIC</u>	91	63	90	80	<u>PENTAMETER</u>	174	174	172	159
<u>PHOTOGRAPH</u>	97	64	92	82	<u>PENTAMETER</u>	174	174	172	159
<u>INTERDEPEND</u>	117	98	98	112	<u>MENTALITY</u>	203	205	158	169
<u>CATASTROPHIC</u>	91	63	90	80	<u>MENTALITY</u>	203	205	158	169
<u>PHOTOGRAPH</u>	97	64	90	80	<u>MENTALITY</u>	203	205	158	169
<u>COCA COLA</u>	123	81	103	88	<u>CALCUTTA</u>	170	125	152	148
<u>PICCADILLY</u>	99	86	105	90	<u>CALCUTTA</u>	170	125	152	148

Appendix Di i

Durations in msec of accented syllables and their counterparts with secondary-like accent and identical position

Word	S1	S2	S3	S4	Word	S1	S2	S3	S4
<u>CAMPBELL</u> *	260	221	203	218	<u>CAMBODIA</u> *	180	170	152	164
<u>CALCIUM</u> *	221	179	190	211	<u>CALCUTTA</u> *	172	165	118	149
<u>MENTAL</u>	278	182	206	197	<u>MENTALITY</u>	177	172	120	134
<u>CAPTAIN</u> *	206	195	176	128	<u>CAPSIZE</u> *	153	151	134	93
<u>SARCASM</u>	263	233	203	187	<u>SARCASTIC</u>	193	188	148	204
<u>FULLNESS</u>	179	192	196	194	<u>FULFIL</u>	243	187	195	202
<u>CONDUCT</u>	344	336	349	317	<u>PRODUCT</u>	275	284	278	236

NB. Durations of target syllables in words marked with * do not include the closure phase of a plosive.

Appendix Diii

Durations in msec of accented syllables and their counterparts with secondary-like accent and different position.

Word	S1	S2	S3	S4	Word	S1	S2	S3	S4
<u>BOYHOOD</u>	206	235	180	146	<u>COWBOY</u>	365	311	345	247
<u>NETTLERASH</u>	406	370	441	357	<u>RATIONAL</u>	279	237	257	240
<u>MEALTIME</u>	240	196	214	223	<u>PIECEMEAL</u>	298	302	324	312
<u>WATCHFUL</u>	265	289	290	288	<u>STOP-WATCH</u>	382	382	373	343
<u>SCHOOL-BOY</u>	397	326	331	367	<u>DAY-SCHOOL</u>	533	377	381	366
<u>HOUSEHOLD</u>	272	256	244	185	<u>POWER-HOUSE</u>	444	377	445	458
<u>FAIRLY</u>	269	192	184	218	<u>THOROUGHFARE</u>	421	230	270	325

Appendix E

Durations of unaccented syllables in pre- and post-tonic positions

Word	S1	S2	S3	S4	Word	S1	S2	S3	S4
<u>FULFIL</u>	256	187	195	221	<u>HARMFUL</u>	331	227	225	239
<u>UPMOST</u>	178	136	150	112	<u>GET UP</u>	225	196	195	167
<u>WHEREBY</u>	200	185	154	155	<u>UNDERWEAR</u>	341	241	294	199
<u>COMMUNICATION</u>	105	74	73	68	<u>MINI</u>	223	227	273	191
<u>MILITARIZATION</u>	88	57	82	95	<u>MILITANT</u>	87	82	97	109
<u>SPECIFICATION</u>	97	105	107	108	<u>SPECIFY</u>	133	116	158	110
<u>REPREHEND</u>	92	60	55	78	<u>CORRIDOR</u>	60	114	87	82
<u>COMMUNICATION</u>	105	74	73	68	<u>UNIVERSE</u>	133	121	78	100

Appendix F

Syllable-durations of disyllabic elements of compounds and of their tokens as simple words.

Word	S1	S2	S3	S4
BLOOD-PRESSURE	194:211	191:164	178:228	206:230
MOUTH-ORGAN	142:262	166:182	135:203	120:240
LETTER-BALANCE	163:440	136:309	151:208	145:374
PEA-SHOOTER	233:283	201:149	146:181	149:162
PENNY-ROYAL	87:130	106:101	97:130	74:164
EASTER-DAY	222:148	117:116	129:138	153:132
RUNNER-UP	162:116	140:84	102:109	98:95
COCA-COLA	96:123	89:81	92:103	103:90
PRESSURE	120:289	137:211	120:251	108:192
ORGAN	172:335	140:221	132:266	146:236
BALANCE	88:446	111:392	105:397	80:363
SHOOTER	257:282	177:165	191:113	151:209
PENNY	126:264	105:213	106:198	110:187
EASTER	235:252	186:162	179:200	168:204
RUNNER	254:275	175:157	119:127	139:160
COCA	132:237	144:216	99:248	125:193

Appendix Gi

Duration in msec of syllables with secondary accent and of their counterparts with secondary-like accent in one-word utterances.

Syllables with secondary accents	S1	S2	S3	S4	Unaccented Syllables	S1	S2	S3	S4
<u>RUMPTITUM</u>	170	174	209	147	<u>RUMBUSTIOUS</u>	<u>208</u>	171	160	139
<u>PENTECOSTAL*</u>	128	129	114	110	<u>PENTAMETER*</u>	<u>152</u>	136	137	115
<u>MILLIONAIRESS</u>	194	127	149	168	<u>MILTONIC</u>	<u>206</u>	125	123	163
<u>SIZEABLE</u>	273	162	197	188	<u>OUTSIZES</u>	<u>331</u>	<u>226</u>	<u>239</u>	<u>251</u>
<u>RENT-FREE</u>	318	220	200	178	<u>LIFE-RENT</u>	<u>340</u>	<u>349</u>	<u>281</u>	<u>242</u>
<u>MATRIMONIAL</u>	166	172	121	149	<u>DOOR-MAT</u>	<u>245</u>	<u>273</u>	<u>268</u>	<u>190</u>

Appendix Gii

Duration in msec of syllables with secondary accent and of their counterparts with secondary-like accent in long utterances.

Syllables with secondary accents	S1	S2	S3	S4	Unaccented Syllables	S1	S2	S3	S4
<u>LOCHNAGAR</u>	215	136	214	215	<u>LOCHLEVEN</u>	<u>225</u>	<u>178</u>	193	208
<u>NEW-FASHIONED</u>	268	262	135	203	<u>NEWTONIAN</u>	185	217	96	123
<u>MILLIONAIRESS</u>	208	213	168	128	<u>MILTONIC</u>	194	172	128	<u>166</u>
<u>RUMPTITUM</u>	194	153	169	170	<u>RUMBUSTIOUS</u>	<u>197</u>	<u>172</u>	148	168

Appendix CUi

Durations in msec of accented syllables and their counterparts with secondary accent

Word	S1	S2	S3	S4	Word	S1	S2	S3	S4
<u>SPECIFI</u> <u>CATIONS</u>	199	181	157	187	<u>SPECIFY</u>	210	189	185	702
<u>FUNDA</u> <u>MENTALS</u>	244	193	145	170	<u>FUNDAMENT</u>	155	193	187	174
<u>ARTIFI</u> <u>CIAL(1)</u>	151	127	105	121	<u>ARTIST</u>	135	124	99	120
<u>PERSEVERED</u>	218	209	179	200	<u>PERSON(2)</u>	219	236	196	235
<u>CATASTRO</u> <u>PHIC(3)</u>	157	78	150	150	<u>CATEGO</u> <u>RIES(4)</u>	171	167	157	187
<u>UNDERLYING</u>	125	136	93	106	<u>UNDERDOGS</u>	217	154	111	112
<u>IMPERCEP</u> <u>TIBILITY</u>	174	172	150	161	<u>SEPARATELY</u>	275	215	255	262
<u>OVERNIGHT</u>	118	90	88	75	<u>OVERSEAS</u>	170	133	93	90
<u>AUTOMATIC</u>	135	103	65	144	<u>AUGUR</u>	191	129	140	178
<u>TRANSOCE</u> <u>ANIC</u>	131	105	103	112	<u>OVERSEAS</u>	170	133	93	90
<u>ECONOMICALLY</u>	97	69	45	67	<u>ERRAND</u>	142	142	84	95
<u>MISUNDER</u> <u>STAND(5)</u>	148	111	133	133	<u>MR (MISTER)</u>	114	72	75	88
<u>SPECIFI</u> <u>CATIONS</u>	199	181	157	187	<u>SPELLING</u>	292	219	256	256

- (1) In the sentence: A HARMONIOUS BOUQUET OF ARTIFICIAL FLOWERS.....
- (2) In the sentence: IT WAS SHOCKING TO FIND MYSELF AT MEALTIME, THE ONLY PERSON AT THE TABLE.
- (3) In the sentence: IT PROVED CATASTROPHIC NOT TO INCLUDE ALL CATEGORIES.....
- (4) In the sentence: THE THREE RATHER THAN THE TWO CATEGORIES OF STUDY.....
- (5) In the sentence: HOPEFULLY, NOBODY'LL MISUNDERSTAND WHAT WE'RE TRYING TO DO.

Appendix CUi

Durations in msec of accented syllables and their counterparts with secondary-like accent

Word	S1	S2	S3	S4	Word	S1	S2	S3	S4
<u>PENCILS</u> (1)	209	228	198	200	<u>PENTAMETER</u>	176	210	172	200
<u>FILTER</u>	210	122	192	131	<u>FILTRATION</u> (2)	136	103	125	105
<u>MENTAL</u>	189	136	176	171	<u>MENTALITY</u> (3)	193	159	130	181
<u>SARCASM</u>	262	215	255	256	<u>SARCASTIC</u>	223	224	174	210
<u>DIMENSIONS</u>	210	204	215	230	<u>MENTALITY</u>	193	159	130	181
<u>ASSESSMENT</u>	245	200	230	232	<u>PROCESS</u> (4)	195	172	176	165
<u>MEALTIME</u>	260	227	187	315	<u>PIECEMEAL</u>	215	213	202	217
<u>UPRIGHT</u>	142	155	157	170	<u>UPHEAVALS</u>	142	114	142	145
<u>MENTIONED</u>	248	181	178	172	<u>MENTALITY</u>	193	159	130	181
<u>RECOMMENDED</u>	202	166	144	195	<u>MENTALITY</u>	193	159	130	181
<u>EXCESS</u>	397	382	384	251	<u>PROCESS</u>	195	172	176	165
<u>NUISANCE</u>	180	122	129	151	<u>NEWTONIAN</u>		196	217	101

(1) In the sentence: WRITING WITH PENCILS ONLY.

(2) In the sentence: AS WE ALREADY KNOW, THE PROCESS OF FILTRATION.

(3) In the sentence: A PERSON WITH A REALLY SEVERE DEFECTIVE MENTALITY... This token of the word is the one used throughout this Appendix.

(4) In the sentence referred to in (2) above. This token of the word is used twice in this Appendix.

Appendix DU

Durations in msec of accented syllables and their unaccented counterparts.

Word	S1	S2	S3	S4	Word	S1	S2	S3	S4
ARTIFI CIAL(1)	113	121	101	99	DIFFICUL TIES	52	110	70	96
ARTIFICIAL	113	121	101	99	DEFINITELY	78	84	86	111
RELIGI OUS(2)	138	110	91	120	IMPERCEPT IBILITY	105	89	90	76
POLITICAL	67	90	97	93	IMPERCEPT IBILITY	105	89	90	76
ADMINI STRATIVE	133	131	91	97	CALAMITOUS	86	90	88	90
SIGNIFI CANT	103	105	90	91	HUMANITY	90	69	73	77
DIFFICUL TIES	127	90	114	150	MODIFIED	116	105	103	97
COMPETI TIONS	133	120	166	153	POLITICAL	67	90	78	93
INTAKE	133	120	114	88	INTENDED	95	84	75	63
CONSIDERED	159	106	103	118	SPECIFY	110	137	135	84
CONSIDERED	159	106	103	118	VERSIFI CATION	125	105	75	73
INTAKE	133	120	114	88	INJECTION	114	107	187	142
CONCEPT	206	243	195	253	CONCEALED	159	142	172	99

(1) In the sentence: A HARMONIOUS BOUQUET OF ARTIFICIAL FLOWERS.

(2) In the sentence: THE FUNDAMENTALS OF RELIGIOUS BELIEF CAN'T BE.

Appendix EU

Duration in msec of pre- and post-tonic *EPD* unaccented syllables

Word	S1	S2	S3	S4	Word	S1	S2	S3	S4
THE FIRST SET									
<u>FULFIL</u>	328	178	146	262	HARM <u>FUL</u>	196	200	226	155
<u>UPHEAVAL</u>	142	114	142	145	GET <u>UP</u>	151	121	105	163
<u>WHEREBY</u>	159	129	136	157	UNDER <u>WEAR</u>	255	195	300	231

THE SECOND SET

SPECIFI CATION	93	122	105	110	SPEC <u>IFY</u>	110	137	135	84
INVESTI GATION	110	69	93	110	POLIT <u>ICAL</u>	67	90	78	93
<u>OVERSEAS</u>	103	69	98	58	<u>OVERNIGHT</u>	97	69	108	81
FUNDA MENTALS	60	64	51	51	FUND <u>AMENTS</u>	67	76	106	75
MISUNDER STAND(1)	73	52	75	90	UNDER <u>DOGS</u>	110	90	83	61
ARTI FICIAL(2)	91	41	83	105	POLIT <u>ICAL</u>	67	90	78	93
VERSIFI CATION	125	105	75	73	SPEC <u>IFY</u>	110	17	135	84

- (1) In the sentence: HOPEFULLY, NOBODY'LL MISUNDERSTAND WHAT WE'RE TRYING TO DO.
- (2) In the sentence: A HARMONIOUS BOUQUET OF ARTIFICIAL FLOWERS.

Appendix H

Durations of syllables in appositional and non-appositional phrases.

Syllable	Type of accent	Appositional or Non-appositional	S1	S2	S3	S4
MIS	ACCENTED	NON-APPOSITIONAL	114	72	75	88
TER	UNACCENTED	"	147	95	97	91
THOMP	ACCENTED	"	234	196	230	206
SON	UNACCENTED	"	196	221	180	196
MY	"	APPOSITIONAL	206	140	155	157
MATHS	ACCENTED	"	234	264	232	266
TEA	"	"	202	168	170	170
CHER	UNACCENTED	"	277	193	195	215
AN	ACCENTED	NON-APPOSITIONAL	190	136	172	138
SWERED	UNACCENTED	"	127	76	120	105
ALL	ACCENTED	"	136	127	133	127
MY	UNACCENTED	"	172	159	106	135
QUES	ACCENTED	"	210	256	238	174
TIONS	UNACCENTED	"	198	217	307	202
SA	SECONDARY	"	174	106	99	109
TIS	UNACCENTED	"	150	153	136	101
FAC	ACCENTED	"	157	127	142	151
TO	UNACCENTED	"	87	142	53	54
RI	"	"	90	67	76	58
LY	"	"	86	75	103	90
THE	"	"	48	61	61	33
CON	ACCENTED	"	225	163	187	185

Syllable	Type of Accent	Appositional or Non-appositional	S1	S2	S3	S4
FÉR	UNACCENTED	NON-APPOSITIONAL	52	118	129	48
RENCE	"	"	236	139	189	300
THE	"	APPOSITIONAL	75	54	50	39
ONE	ACCENTED	"	136	105	118	129
IN	UNACCENTED	"	103	90	99	88
LON	ACCENTED	"	202	183	142	184
DON	UNACCENTED	"	240	103	219	161
IS	"	NON-APPOSITIONAL	118	105	103	69
BE	"	"	155	97	93	112
LIEVED	ACCENTED	"	202	178	142	208
TO	UNACCENTED	"	75	127	105	97
HAVE	"	"	136	140	82	97
COME	ACCENTED	"	298	210	228	204
TO	UNACCENTED	"	110	103	95	90
SOME	"	"	213	180	119	204
SIG	"	"	172	135	150	180
NI	ACCENTED	"	103	105	90	91
FI	UNACCENTED	"	84	52	61	76
CANT	"	"	157	165	165	157
CON	"	"	144	99	142	153
CLU	ACCENTED	"	219	221	187	184
SIONS	UNACCENTED	"	309	307	226	245
THE	"	"	48	60	72	56
VIC	ACCENTED	"	150	159	125	123
TIMS	UNACCENTED	"	191	279	217	217
OF	"	"	80	84	129	84

Syllable	Type of Accent	Appositional or Non-appositional	S1	S2	S3	S4
THE	UNACCENTED	NON-APPOSITIONAL	93	112	101	95
FIRE	ACCENTED	"	412	333	294	360
HALF	"	APPOSITIONAL	262	211	172	262
OF	UNACCENTED	"	65	84	93	97
THEM	"	"	144	106	99	144
CHILD	ACCENTED	"	255	262	234	266
REN	UNACCENTED	"	241	157	187	166
HAVE	ACCENTED	NON-APPOSITIONAL	118	84	136	120
AT	UNACCENTED	"	97	118	103	108
LAST	ACCENTED	"	286	253	251	270
BEEN	UNACCENTED	"	135	99	112	136
I	"	"	135	93	72	105
DEN	ACCENTED	"	150	120	129	135
TI	UNACCENTED	"	84	91	101	120
FIED	"	"	313	240	285	241

Appendix Ii

Syllable-durations in msec in the normal speech-rate.

Syllable	S1	S2	S3	S4
	~	~	~	~
A	103	55	58	50
	*	*	*	*
HOT	185	262	232	174
	?	?	?	?
POT	300	354	238	223
	~	~	~	~
IS	116	93	97	91
	*	*	*	*
QUITE	206	322	277	245
	~	~	~	~
E	46	37	31	39
	*	*	*	*
NOUGH	180	243	217	165
	~	~	~	?
FOR	75	45	61	136
	?	*	?	*
MY	155	241	144	191
	*	*	*	*
LUNCH	376	480	360	288
	~	~	~	~
HE	129	80	97	75
	*	*	*	*
STILL	361	427	281	296
	*	*	*	*
DOUBTS	324	399	328	365
	~	~	~	~
THE	103	113	84	112
	*	*	*	*
FOOL	240	158	241	204

- * Accented Syllable
- ~ Syllables with Secondary Accent
- ? Syllables with Secondary-like Accent
- ~ Unaccented Syllables

Syllable	S1	S2	S3	S4
PROOF	[?] 240	[?] 251	[?] 217	[?] 228
E	[*] 121	[*] 75	[*] 99	[*] 110
VI	[~] 69	[~] 82	[~] 103	[~] 48
DENCE	[~] 232	[~] 232	[~] 277	[~] 277
THEY	[?] 150	[?] 127	[~] 105	[?] 127
PRO	[~] 133	[~] 232	[~] 112	[~] 118
DUCE	[*] 365	[*] 240	[*] 345	[*] 285
THE	[~] 52	[~] 40	[~] 67	[~] 58
PRO	[*] 225	[*] 240	[*] 195	[*] 245
CESS	[?] 222	[?] 193	[~] 129	[?] 262
OF	[~] 88	[~] 75	[~] 65	[?] 121
FIL	[?] 193	[?] 170	[~] 112	[~] 110
TRA	[*] 234	[*] 250	[*] 225	[*] 225
TION	[~] 217	[~] 200	[~] 246	[~] 218
DID	[*] 153	[*] 76	[*] 90	[*] 114
N'T	[~] 95	[~] 125	[~] 90	[~] 93
AC	[*] 153	[*] 144	[*] 146	[*] 144
TU(A)	[~] 135	[~] 106	[~] 141	[~] 123

Syllable	S1	S2	S3	S4
	~		~	~
A	76	-	61	43
	~	~	~	~
LLY	58	97	176	144
	?	?	?	?
FUL	172	198	185	150
	*	*	*	*
FIL	185	208	157	159
	~	~	~	~
THE	65	114	97	88
	^	^	^	^
EX	183	132	189	196
	?	?	?	?
PEC	170	157	148	150
	*	*	*	*
TA	174	180	196	198
	~	~	~	~
TIONS	217	150	219	225
	~	~	~	~
OF	73	75	61	50
	~	~	~	~
THE	67	56	60	75
	^	^	^	^
MAN	165	198	153	202
	~	~	~	~
U	73	63	80	58
	*	*	*	*
FAC	191	183	180	187
	~	~	~	~
TU(A)	135	135	90	151
	~	~	~	~
RER	133	121	131	90
	~	~	~	~
THE	70	54	88	41
	*	*	*	*
TI	234	195	193	207

Syllable	S1	S2	S3	S4
	~	~	~	~
TLE	157	112	129	168
	?	?	?	*
IS	196	176	208	375
	?	?	?	?
DI	193	195	157	211
	*	*	*	*
MEN	210	204	215	230
	~	~	~	~
SIONS	241	215	270	253
	~	~	~	~
OF	116	82	84	103
	?	?	?	?
MEN	166	210	142	187
	*	*	*	*
TA	191	180	166	159
	~	~	~	~
LI	106	103	110	67
	~	~	~	~
TY	117	225	168	217
	~	*	~	~
AND	99	243	129	84
	*	*	*	*
SO	210	255	200	218
	~	~	~	~
CIAL	271	235	279	187
	~	~	~	~
A	65	83	67	73
	?	?	?	?
DAP	219	133	136	151
	*	*	*	*
TA	155	217	202	217
	~	~	~	~
TION	309	270	277	322
	*	?	?	*
THEY('LL)	123	124	110	118

Syllable	S1	S2	S3	S4
'LL	75	-	-	63
CON	166	152	129	163
DUCT	247	273	195	273
AN	54	95	50	91
IN	140	105	144	155
VES	180	170	215	149
TI	110	69	93	110
GA	225	165	183	195
TION	223	243	159	270
ON	150	105	93	120
PRO	191	228	195	161
DUCTS	286	240	331	165
WITH	140	101	105	121
AR	138	136	99	106
TI	65	105	125	86
FI	150	76	56	125
CIAL	151	157	165	127
CO	165	155	180	180

Syllable	S1	S2	S3	S4
	~	~	~	~
LOU	61	96	67	120
	~	~	~	~
RING	142	204	63	114
	~	*	~	~
IT	118	369	84	80
	*	?	*	*
PROVED	360	170	401	303
	^	^	^	^
CA	157	78	150	150
	~	~	~	~
TA	95	78	75	63
	*	*	*	*
STRO	283	219	256	230
	~	~	~	~
PHIC	210	187	183	133
	*	?	*	?
NOT	204	150	213	150
	~	~	~	~
TO	78	60	97	90
	~	~	~	~
IN	172	114	121	140
	*	*	*	*
CLUDE	296	250	305	191
	*	?	~	*
ALL	211	159	121	191
	*	*	*	*
CA	157	198	172	144
	~	~	~	~
TE	78	99	99	121
	~	~	~	~
GO	86	90	91	75
	~	~	~	~
RIES	90	140	110	150
	~	~	~	~
IN	106	84	71	90

Syllable	S1	S2	S3	S4
	~	~	~	~
THE	73	67	193	90
	*	*	*	*
STU	202	174	129	172
	~	~	~	~
DY	146	127	129	144

Appendix Iii

Syllable	Syllable durations in msec in the fast speech-rate			
	S1	S2	S3	S4
A	50	24	45	39
HOT	144	129	189	144
POT	144	125	174	149
IS	80	54	97	91
QUITE	163	157	273	166
E	52	24	45	37
NOUGH	155	108	144	170
FOR	67	45	82	73
MY	120	136	86	174
LUNCH	262	270	378	236
HE	86	54	112	65
STILL	242	153	270	219
DOUBTS	204	213	331	286
THE	67	30	88	69
FOOL	155	125	189	151
PROOF	159	142	180	215
E	73	61	61	75

Use of *, ^, ? and ~ as in Appendix Ii above.

Syllable	S1	S2	S3	S4
	~	~	~	~
VI	71	45	60	69
	~	~	~	~
DENCE	165	140	166	211
	?	~	?	?
THEY	110	71	99	114
	~	~	~	~
PRO	105	63	93	85
	*	*	*	*
DUCED	226	256	253	245
	~	~	~	~
THE	54	-	60	43
	*	*	*	*
PRO	150	148	219	144
	?	~	~	?
CESS	170	105	140	189
	~	~	~	~
OF	84	60	82	63
	?	~	~	?
FIL	125	106	103	150
	*	*	*	*
TRA	183	168	211	198
	~	~	~	~
TION	165	127	108	166
	*	*	*	*
DID	114	93	82	97
	~	~	~	~
N'T	69	67	80	88
	*	*	*	*
AC	114	82	82	114
	~	~	~	~
TU(A)	80	78	75	68
	~	~	~	~
A	-	-	43	38
	~	~	~	~
LLY	97	69	97	82

Syllable	S1	S2	S3	S4
	?	?	?	?
FUL	125	144	180	165
	*	*	*	*
FIL	150	129	159	189
	~	~	~	~
THE	52	52	82	60
	^	^	^	^
EX	180	106	180	195
	?	?	?	?
PEC	129	99	155	112
	*	*	*	*
TA	130	123	168	210
	~	~	~	~
TIONS	181	127	225	174
	~	~	~	~
OF	33	33	61	76
	~	~	~	~
THE	30	35	73	63
	^	^	^	^
MAN	116	103	146	140
	~	~	~	~
U	48	39	97	75
	*	*	*	*
FAC	136	120	135	166
	~	~	~	~
TU	84	82	88	138
	~	~	~	~
RER	103	114	151	83
	~	~	~	~
THE	46	46	56	63
	*	*	*	*
TI	206	128	193	226
	~	~	~	~
TLE	103	80	121	97
	~	?	*	?
IS	67	105	211	114

Syllable	S1	S2	S3	S4
DI	? 142	-	? 131	? 150
MEN	* 155	* 90	* 133	* 165
SIONS	~ 157	~ 136	~ 195	~ 189
OF	~ 58	~ 71	~ 61	~ 67
MEN	? 125	? 106	? 106	? 210
TA	* 121	* 131	* 136	* 138
LI	~ 71	~ 52	~ 84	~ 76
TY	~ 78	~ 82	~ 120	~ 165
AND	~ 93	~ 52	? 138	~ 72
SO	* 144	* 146	* 163	* 172
CIAL	~ 93	~ 116	~ 223	~ 131
A	~ 69	~ 35	~ 37	~ 73
DAP	? 106	? 108	? 135	? 131
TA	* 172	* 121	* 163	* 176
TION	~ 116	~ 174	~ 196	~ 189
THEY('LL)	? 122	~ 63	? 110	* 90
'LL	-	-	-	~ 69
CON	~ 131	~ 106	~ 129	~ 105

Syllable	S1	S2	S3	S4
	*	*	*	*
DUCT	198	127	189	174
	~	~	~	~
AN	63	60	45	106
	~	~	~	~
IN	118	75	146	93
	~	~	~	~
VES	135	97	219	148
	~	~	~	~
TI	78	67	95	106
	*	*	*	*
GA	172	110	172	178
	~	~	~	~
TION	129	82	168	129
	?	?	?	?
ON	108	90	90	114
	*	*	*	*
PRO	114	106	181	135
	?	~	?	~
DUCTS	221	150	256	135
	~	~	~	~
WITH	55	114	101	90
	~	~	~	~
AR	90	80	101	99
	~	~	~	~
TI	54	45	121	75
	*	*	*	*
FI	99	101	88	112
	~	~	~	~
CIAL	129	86	150	105
	*	*	*	*
CO	129	165	159	172
	~	~	~	~
LOU	75	88	69	97
	~	~	~	~
RING	82	103	69	90

Syllable	S1	S2	S3	S4
	~	~	~	~
IT	52	75	84	60
	*	*	*	*
PROVED	208	172	281	241
	~	~	~	~
CA	116	135	118	157
	~	~	~	~
TA	73	50	75	65
	*	*	*	*
STRO	211	215	256	176
	~	~	~	~
PHIC	144	166	183	125
	?	?	*	?
NOT	150	123	221	151
	~	~	~	~
TO	69	112	105	61
	~	~	~	~
IN	78	88	108	114
	*	*	*	*
CLUDE	159	181	256	174
	?	?	*	*
ALL	120	91	146	148
	*	*	*	*
CA	131	135	159	144
	~	~	~	~
TE	69	73	75	118
	~	~	~	~
GO	76	105	110	60
	~	~	~	~
RIES	148	56	101	180
	~	~	~	~
IN	67	52	82	99
	~	~	~	~
THE	60	60	56	93
	*	*	*	*
STU	161	114	148	146

Syllable	S1	S2	S3	S4
	~	~	~	~
DY	76	117	142	112

Appendix J

Durations in msec of target syllables in one-word and longer utterances.

Word	One-word utterances							
	S1		S2		S3		S4	
<u>HARM</u> <u>LESS</u>	355	314	360	339	294	320	227	258
<u>HARM</u> <u>FUL</u>	281	331	266	227	236	225	283	239
<u>COMPREHEND</u>	152	465	219	330	183	360	160	328
<u>REPREHEND</u>	196	571	153	168	187	382	172	305
<u>UN</u> <u>COMFORTABLE</u>	163	253	113	201	104	212	114	226

Word	Long utterances							
	S1		S2		S3		S4	
<u>HARM</u> <u>LESS</u>	277	442	225	230	243	360	259	441
<u>HARM</u> <u>FUL</u>	255	345	225	270	228	326	264	294
<u>COMPREHEND</u>	260	286	286	258	262	242	322	391
<u>REPREHEND</u>	255	282	230	277	168	326	255	318
<u>UN</u> <u>COMFORTABLE</u>	149	196	152	180	130	194	177	1731

(Spaces are left within some words where a target syllable immediately follows another)

Appendix K

Syllable durations in msec in one word and longer utterances

Syllable	One-word Utterance				Longer Utterance			
	S1	S2	S3	S4	S1	S2	S3	S4
UN	150	99	84	75	127	91	75	99
DER	84	46	37	65	77	81	65	61
STAN	285	260	311	292	77	81	65	61
DA	76	65	89	82	53	50	83	67
BLE	166	124	187	151	141	136	161	185
E	76	43	41	45	73	35	67	75
LEC	165	138	135	153	158	170	115	149
TRO	171	133	149	122	163	94	145	156
CHE	222	136	163	139	157	115	116	102
MI	84	69	104	93	87	69	96	79
STRY	351	240	273	292	420	300	183	190
FUL	256	187	195	221	234	163	182	217
FIL	375	299	358	341	328	178	146	262
MIS (1)	128	144	114	137	148	111	133	133
UN	147	138	75	101	130	127	113	103
DER	86	52	81	55	73	52	75	90
STAND	540	406	407	334	309	270	380	316
LON	241	270	229	183	166	241	170	195

(1) In the sentence: HOPEFULLY, NOBODY'LL MISUNDERSTAND WHAT WE'RE TRYING TO DO.

(continued below)

Syllable	One-word Utterance				Longer Utterance			
	S1	S2	S3	S4	S1	S2	S3	S4
DON	205	198	217	189	90	127	97	129
FIL	162	102	119	129	136	103	125	105
TRA	246	233	204	243	236	215	183	220
TION	337	265	310	315	246	168	270	163
STAND (1)	429	322	367	386	347	331	267	322
UP	209	177	211	160	207	228	155	205
VER	217	136	78	149	133	153	148	159
SI	148	125	142	129	125	105	75	73
FI	64	74	66	75	69	95	93	76
CA	215	200	190	198	219	187	191	206
TION	359	211	307	337	249	210	247	227
MA	103	77	84	67	101	88	90	133
CHINE	380	294	266	298	240	262	315	178
GUN(S)	322	271	247	225	285	286	259	285
MEN	177	172	120	134	193	159	130	181
TA	203	205	158	169	158	150	150	133
LI	99	69	79	85	96	80	90	82
TY	313	222	218	220	200	178	180	225
SEN	262	265	221	236	231	187	176	141
DING	273	228	286	212	146	133	126	137
WHERE	200	185	154	155	159	129	136	157
BY	510	337	365	331	264	255	207	245

(1) in the sentence: I DON'T MEAN YOU SHOULD STAND UP.

(continued below)

Syllable	One-word Utterance				Longer Utterance			
	S1	S2	S3	S4	S1	S2	S3	S4
RE	108	90	90	83	103	123	90	98
SU	196	142	129	153	175	148	120	143
SCI	150	76	112	113	88	114	105	105
TATE	311	223	247	245	247	240	168	222
UN	157	189	119	99	150	137	112	95
DER	110	91	88	121	88	73	75	74
WEAR	341	241	294	199	255	195	300	231
LOCH	243	229	123	161	285	195	279	187
LE	243	179	174	190	211	173	172	202
VEN	308	198	256	188	276	202	212	225
MEN	278	182	206	197	189	136	176	171
TAL	279	221	300	268	181	140	155	127
AIR	154	159	123	130	217	207	180	206
PORT	339	219	348	314	222	225	226	213
HARM	282	264	236	279	270	213	222	277
FUL	331	275	225	239	196	200	226	155
MEAL	240	196	214	223	260	227	187	315
TIME	364	356	313	346	335	365	290	403
SPE	167	182	230	222	210	189	185	202
CI	133	116	158	110	110	137	135	84
FY	342	278	337	253	271	262	243	234
SPEN	375	378	310	315	286	272	224	301
DING	441	245	243	230	171	209	194	216
RE	162	79	70	99	118	64	62	82
TURN	408	466	463	433	268	204	246	282
SAR	193	188	148	204	223	224	174	210

(continued below)

Syllable	One-word Utterance				Longer Utterance			
	S1	S2	S3	S4	S1	S2	S3	S4
CAS	324	279	289	237	233	294	292	219
TIC	214	202	225	207	117	137	108	135
SPE	145	170	146	201	199	181	157	187
CI	97	105	107	108	93	122	105	110
FI	103	75	79	96	111	74	75	67
CA	216	199	200	211	189	194	161	206
TION(S)	339	230	326	281	406	248	355	275
AR	170	156	131	142	135	124	99	120
TIST	373	329	339	312	224	196	220	197
LAND	340	301	234	278	252	313	210	241
LORD	248	169	288	250	203	105	157	120
FUN	187	131	140	187	155	193	187	174
DA	81	64	66	87	67	76	106	75
MENT	255	185	268	185	240	200	268	309
SAR	263	233	203	187	262	215	255	256
CA	207	195	141	173	174	185	142	159
SM	279	222	238	220	228	159	166	189
A	120	88	81	78	111	99	142	112
VA	111	92	92	76	78	82	88	90
LANCHE	500	356	438	356	328	298	228	248
AR	150	95	105	107	112	165	136	140
CHI	121	118	117	88	120	84	66	91
TECT	346	303	298	239	268	211	241	208
RUMP	170	174	209	147	194	153	248	170
TI	107	122	133	139	110	112	106	114
TUM	423	293	187	283	334	211	247	318
(continued below)								

Syllable	One-word Utterance				Longer Utterance			
	S1	S2	S3	S4	S1	S2	S3	S4
MIL	206	125	123	163	194	172	144	166
TO	208	176	171	154	75	148	142	149
NIC	189	161	180	160	258	129	144	154
MEN (1)	-	24	232	222	235	172	131	136
DING	-	210	219	262	210	112	192	134
STAND	440	316	317	366	420	352	309	369
STILL	438	281	299	310	336	255	319	292
MOU TH	254	301	269	272	269	269	207	280
OR	142	166	135	120	105	78	90	105
GAN	262	182	203	240	128	238	107	188
NEW	221	173	122	150	196	217	101	130
TON	310	315	237	225	266	323	210	210
IAN	326	232	219	165	181	218	181	158
FUN	139	164	116	186	155	193	187	174
DA	117	69	72	79	67	76	106	75
MEN	222	136	173	184	230	168	158	139
TAL(S)	246	224	238	226	270	187	307	144
RUM	205	171	160	139	197	172	148	168
BUS	202	200	233	172	206	221	241	134
TIOUS	365	312	394	281	272	168	202	217
MILL	194	127	149	168	208	213	136	170
IO	112	52	52	112	97	56	73	81

(1) In the phrase: MENDING THE SHOES of the sentence: ~~THE~~ COBBLER
NEVER GOT ROUND TO MENDING THE SHOES.

(continued below)

Syllable	One-word Utterance				Longer Utterance			
	S1	S2	S3	S4	S1	S2	S3	S4
NAI	200	187	168	172	246	174	174	95
RESS	253	316	373	274	220	234	283	111
OR	172	140	132	146	105	93	115	137
GAN	335	221	266	236	171	233	157	214
LEN	264	235	214	254	253	254	170	182
DING	276	210	228	262	130	179	168	200
AU	127	147	49	101	140	129	91	129
GUST	461	446	383	330	337	412	283	339
HOT	237	140	199	144	185	262	232	174
POT	324	214	282	237	300	354	238	223
FOOL	226	255	236	206	240	158	241	204
PROOF	247	330	273	247	240	251	217	228
NON	225	230	188	228	218	198	244	233
STOP	398	305	329	306	350	282	246	282
STAND (1)	429	322	367	386	320	305	268	299
UP	209	177	211	160	221	165	175	133
MIS (2)	128	144	114	137	117	138	119	144
UN	147	138	75	101	128	159	80	109
DER	86	52	81	55	76	65	84	63
STAND	540	406	407	334	383	448	426	450
MIS (3)	128	144	114	137	150	209	158	128

(1) in the sentence: STAND UP WHEN THE TEACHER COMES IN.

(2) in the sentence: MISUNDERSTAND IS A WORD HE IS ALWAYS USING.

(3) in the sentence: HE SHOULDN'T KEEP ON SAYING THE WORD MISUNDERSTAND.

Syllable	One-word Utterance				Longer Utterance			
	S1	S2	S3	S4	S1	S2	S3	S4
UN	147	138	75	101	149	163	103	109
DER	86	52	81	55	79	88	96	83
STAND	540	406	407	334	442	472	380	413
STAND (1)	429	322	367	386	306	308	251	332
UP	209	177	211	160	158	126	159	153
MEN	-	245	232	222	182	173	165	157
DING	-	210	219	262	212	106	133	161

(1) In the sentence: I WONDER IF WE'RE GOING TO HAVE TO STAND UP ALL AFTERNOON.

(2) In the phrase: MENDING THE BOOTS in the sentence: THE COBBLER NEVER GOT ROUND TO MENDING THE SHOES; HE WAS BUSY MENDING BOOTS.

Appendix L

Syllable durations in msec in a corpus of 50 sentences

Syllable	S1	S2	S3	S4
THE	~ 75	~ 31	~ 46	~ 61
IM	* 127	* 147	* 112	* 97
PER	~ 105	~ 99	~ 69	~ 97
CEP	^ 174	^ 172	^ 150	^ 161
TI	~ 91	~ 85	~ 91	~ 112
BI	x 95	x 69	x 80	x 99
LI	~ 105	~ 89	~ 90	~ 76
TY	~ 112	~ 127	~ 87	~ 148
OF	~ 90	~ 63	~ 67	~ 61
SUCH	x 271	x 270	x 240	x 210
THINGS	* 270	* 259	* 249	* 219
IS	~ 116	~ 84	~ 97	~ 88
QUITE	x 240	x 201	x 262	x 232
UN	~ 127	~ 91	~ 75	~ 99

* Syllables with Primary Tonic Accent

x Syllables with Primary Non-tonic Accent

^ Syllables with EPD-marked Secondary Accent

? Syllables with Secondary-like Accent in Polysyllabic words

. Syllables with Secondary-like Accent in Monosyllabic words

~ Unaccented Syllables

Syllable	S1	S2	S3	S4
	~	~	~	~
DER	77	81	65	61
	*	*	*	*
STAN	225	261	259	214
	~	~	~	~
DA	53	50	83	67
	~	~	~	~
BLE	141	136	161	185
	~	~	~	~
WE	84	62	69	67
	~	~	~	~
	x	x	x	x
TOOK	144	122	132	135
	~	~	~	~
A	61	48	47	52
	*	*	*	*
TA(k)	240	204	197	208
	~	~	~	~
(S)I	161	257	192	166
	~	~	~	~
BUT	150	82	102	103
	~	~	~	~
THE	82	52	102	103
	*	*	*	*
CAB	219	247	240	280
	~	~	~	~
	?	?	~	~
MAN	262	202	195	168
	~	~	~	~
	x	x	x	x
DID	120	112	105	114
	~	~	~	~
N'T	84	91	82	84
	~	~	~	~
	x	x	*	x
KNOW	196	208	215	180
	~	~	~	~

WHERE	135	114	142	120
	~	~	~	~
THE	54	40	54	58

Syllable	S1	S2	S3	S4
PLACE	x 255	x 298	x 300	x 217
WAS	* 262	* 290	* 330	* 258
THE	~ 69	~ 77	~ 67	~ 75
FRE	x 211	* 174	x 153	x 159
QUENT	~ 187	~ 181	~ 172	~ 189
PO	~ 138	~ 148	~ 97	~ 86
LI	x 67	* 90	* 78	x 93
TI	~ 101	~ 114	~ 90	~ 90
CAL	~ 198	~ 234	~ 252	~ 151
RA	x 172	x 157	x 137	x 255
THER	~ 116	~ 114	~ 97	~ 114
THAN	~ 125	• 159	• 150	~ 109
SO	x 195	* 202	x 174	* 225
CIAL	~ 157	~ 166	~ 63	~ 189
UP	? 142	? 114	? 142	? 145
HEA	* 151	x 171	* 180	x 170
VALS	~ 301	~ 291	~ 264	~ 226
DON'T	-	-	x 215	x 252

Syllable	S1	S2	S3	S4
AU	^x 191	^x 129	^x 140	^x 178
GUR	~ 118	~ 153	~ 120	~ 133
WELL	* 262	* 252	* 236	* 331
FOR	~ 90	~ 72	~ 82	~ 56
THE	~ 71	~ 198	~ 78	~ 73
COUN	^x 187	^x 170	^x 147	^x 220
TRY'S	~ 249	~ 229	~ 228	~ 235
FU	^x 131	^x 92	^x 142	^x 118
TURE	~ 159	~ 167	~ 142	~ 135
WEL	* 215	* 195	* 202	* 221
FARE	? 225	? 225	? 210	? 200
IT'S	~ 150	~ 110	~ 102	~ 108
A	~ 63	~ 35	~ 63	~ 60
PER	* 255	* 178	* 137	* 178
MA	~ 90	~ 101	~ 111	~ 67
NENT	~ 176	~ 114	~ 187	~ 172
RA	^x 170	^x 118	^x 135	^x 193
THER	~ 120	~ 78	~ 132	~ 90

Syllable	S1	S2	S3	S4
	~	~	~	~
THAN	110	106	105	110
	~	~	~	~
A	95	47	59	90
	*	*	*	*
TEM(P)	255	240	202	234
PO	-	-	-	-
	~		~	~
RA	120	-	86	125
	~	~	~	~
RY	106	153	99	67
	x	x	x	x
FIL	210	122	192	131
	~	~	~	~
TER	108	189	153	150

THAT	136	84	129	120
		~	~	~
	.			
WE	129	105	108	75
	*	*	*	*
WANT	247	195	245	172
	*	~	~	~
MI(1)	87	69	96	79
	~	~	~	~
STRY	420	300	183	190
	~	~	~	
				.
AND	118	105	90	130
	~	~	~	~
E	73	35	67	75
	~	~	~	*
LEC	159	170	115	149
	?	~	?	?
TRO	163	94	145	156

(1) The first syllable in the word "Chemistry" is not included for reasons of measurement.

Syllable	S1	S2	S3	S4
CHE	^x 157	^x 115	^x 116	^x 102
MI	[~] 101	[~] 93	[~] 80	[~] 85
STRY	[~] 201	[~] 167	[~] 153	[~] 159
BOOKS	[*] 292	[*] 328	[*] 436	[*] 241
ARE	[.] 129	[~] 87	[~] 97	[~] 67
ON	[~] 90	[~] 90	[~] 67	[~] 75
THE	[~] 85	[~] 97	[~] 46	[~] 64
SAME	[*] 311	^x 257	^x 237	[*] 223
SHELF	^x 390	[*] 392	[*] 405	^x 361
ONCE	^x 210	^x 180	^x 211	^x 238
YOU	[.] 143	[~] 52	[~] 86	[~] 103
FUL	[?] 234	[?] 163	[?] 182	[?] 217
FIL	^x 328	^x 178	^x 146	^x 262
THESE	[.] 136	^x 166	[.] 106	[*] 208
EX	[~] 135	[~] 131	[~] 176	[~] 133
PEC	[?] 189	[?] 174	[?] 123	[?] 165
TA	[*] 210	[*] 181	[*] 204	^x 223
TIONS	[~] 345	[~] 315	[~] 303	[~] 217

Syllable	S1	S2	S3	S4
YOU'RE	181 [.]	125 [.]	170 [.]	187 [.]
SURE	195 ^x	195 ^x	222 ^x	213 ^x
TO	95 [~]	127 [~]	92 [~]	75 [~]
FIND	247 ^x	322 [*]	292 [*]	268 ^x
SOME	129 ^x	159 ^x	168 ^x	136 ^x
O	115 [*]	84 ^x	60 ^x	99 [*]
THERS	158 [~]	135 [~]	129 [~]	170 [~]
WILL	105 [~]	162 [.]	183 [.]	91 [~]
A	67 [~]	114 [~]	45 [~]	60 [~]
RISE	399 [*]	270 [*]	289 [*]	313 [*]
HOPE	151 [*]	153 [*]	157 [*]	208 [*]
FU	159 [~]	109 [~]	147 [~]	103 [~]
LLY	159 [~]	138 [~]	144 [~]	142 [~]
NO	138 ^x	118 [*]	123 ^x	151 ^x
BO	65 [~]	75 [~]	192 [?]	73 [~]
DY	105 [~]	118 [~]	110 [~]	84 [~]
'LL	45 [~]	125 [~]	112 [~]	43 [~]
MIS	148 [~]	111 [~]	133 [~]	133 [~]

Syllable	S1	S2	S3	S4
UN	130	127	113	103
DER	73	52	75	90
STAND	309	270	382	316
WHAT	150	90	90	174
WE'RE	120	106	91	96
TRY	195	181	187	161
ING	80	80	52	61
TO	97	75	112	106
DO	281	305	217	230
HE	98	90	78	93
DROVE	305	328	268	318
NON	218	198	244	233
STOP	312	282	246	282
TO	54	120	103	97
THE	100	54	50	64
PO	91	125	97	118
LICE	148	159	148	106
STA	210	219	204	216

Syllable	S1	S2	S3	S4
TION	144	180	193	178
AS	157	137	131	75
WE	79	67	63	75
AL	172	117	112	183
REA	141	105	72	88
DY	120	97	97	90
KNOW	368	257	240	277
THE	73	46	86	73
PRO	184	196	120	165
CESS	195	172	176	165
OF	76	63	86	88
FIL	136	103	125	105
TRA	236	215	183	220
TION	246	168	270	163
IS	150	136	133	135
FAR	217	217	240	202
FROM	123	143	105	158
A	93	77	106	84

Syllable	S1	S2	S3	S4
	~	~	~	~
DE	106	113	129	133
	~	~	~	~
QUATE	135	210	126	151
	~	~	~	~
I	129 [.]	39 [.]	66 [.]	46 [.]
	~	~	~	~
HAVE	195 [.]	157	180 [.]	136
	~	~	~	~
THE	80	47	54	75
	~	~	~	~
FEE	189 [*]	165 [*]	135 ^x	196 [*]
	~	~	~	~
LING	220	186	110	135
	~	~	~	~
THAT	136 [.]	78	86	150 [.]
	~	~	~	~
HIS	121	146	138	216
	~	~	~	~
VER	133	153	148	159
	~	~	~	~
SI	125	105	75	73
	~	~	~	~
FI	69	95	93	76
	~	~	~	~
CA	219 [*]	187 [*]	191 [*]	206 [*]
	~	~	~	~
TION	249	210	247	227
	~	~	~	~
IS	150 [.]	103	71	95
	~	~	~	~
AT	118	37	67	76
	~	~	~	~
ITS	155	75	180 [.]	125
	~	~	~	~
BEST	346 [*]	318 [*]	327 [*]	303 [*]
	~	~	~	~

Syllable	S1	S2	S3	S4
WHEN	136 [.]	90 [.]	108 [.]	129 [.]
IT	90	93	87	78
DEALS	258 ^x	211 ^x	246 ^x	255 ^x
WITH	129	132	114	99
NA	264 [*]	150 [*]	161 [*]	181 [*]
TURE	219	180	189	223
IT	86	55	75	63
WAS	117	114	116	120
AU	135	103	65	144
TO	90	71	97	90
MA	163 [*]	155 [*]	146 [*]	180 [*]
TIC	187	180	187	206
RA	241 ^x	138 ^x	153 ^x	260 ^x
THER	90	125	116	88
THAN	90	137	117	210 ^x
SUCH	208 ^x	223 ^x	219 ^x	211 ^x
OLD	279	184	135	175
FA	186 [*]	206 [*]	196 ^x	186 [*]

Syllable	S1	S2	S3	S4
	~	~	~	~
SHIONED	181	150	182	200
	~	~	~	~
MA	101	88	90	133
	*	*	*	*
CHINE	240	262	315	178
	~	~	~	~
	?	?	?	?
GUNS	285	286	259	285
	~	~	~	~
WE	63	77	93	90
	x	x	x	x
WAN	240	112	150	127
	~	~	~	~
TED	118	135	82	88
	~	~	~	~
TO	73	60	65	67
	~	~	~	~
GET	129	120	112	150
	*	*	*	*
HOLD	228	240	221	204
	~	~	~	~
OF	97	197	160	120
	~	~	~	~
IN	93	60	45	60
	~	~	~	~
THE	58	48	37	37
	x	x	x	x
MI	127	142	142	92
	~	~	~	~
DDLE	129	103	120	120
	~	~	~	~
OF	65	82	71	167
	~	~	~	~
THE	117	63	45	90
	*	*	*	*
WASH	391	330	367	324

Syllable	S1	S2	S3	S4
THE	50	46	50	54
WA	130	101	140	114
SHING	140	132	146	144
MA	105	63	68	90
CHINE	213	212	315	208
BROKE	213	202	225	208
DOWN	264	313	246	322
A	76	60	48	69
PER	208	193	198	217
SON	185	142	141	245
WITH	120	193	103	133
A	93	90	67	106
REA	202	277	126	104
LLY	110	107	112	96
SE	150	150	150	217
VERE	270	217	195	285
DE	91	84	108	97
FEC	196	179	175	185

Syllable	S1	S2	S3	S4
	~	~	~	~
TIVE	173	161	157	195
	?	?	?	?
MEN	193	159	130	181
	*	*	*	*
TA	158	150	150	133
	~	~	~	~
LI	96	80	90	82
	~	~	~	~
TY	200	178	180	225
	x	.	.	~
SHOULD	201	144	172	91
	~	~	~	~
BE	86	82	60	108
	~	~	~	~
CON	125	142	135	157
	x	x	x	x
SI	159	106	103	118
	~	~	~	~
DERED	91	120	102	153
	*	*	*	*
SE(P)	275	215	255	262
	-	-	-	-
(PA)	-	-	-	-
	~	~	~	~
RATE	174	180	118	150
	~	~	~	~
LY	103	116	101	129
	~	.	~	~
FROM	127	182	105	121
	~	~	~	~
THE	91	112	56	54

Syllable	S1	S2	S3	S4
	*	*	*	*
O	125	118	127	159
	~	~	~	~
THERS	256	228	326	195
	~	~	~	~
WE 'D	93	121	108	125
	x	x	x	x
BE	121	90	113	136
	~	~	~	~
TTER	91	87	90	93
	x	x	x	x
PUT	181	270	150	133
	~	x	~	.
THIS	118	232	105	142
	~	~	~	~
PAR	99	99	120	146
	x	x	x	x
TIC	159	155	172	142
	~	~	~	~
U	52	73	71	75
	~	~	~	~
LAR	106	67	99	96
	*	*	*	*
POR	202	166	189	181
	?	?	~	?
TRAIT	211	245	195	178
	~	.	~	~
IN	108	127	101	61
	~	~	~	~
THE	55	67	61	105
	*	*	*	*
LOUNGE	337	495	397	395
	~	~	~	~
HE	105	75	76	133
	~	~	~	~
DE	120	90	95	135

Syllable	S1	S2	S3	S4
SIGNED	^x 397	^x 306	^x 255	^x 290
THE	[~] 60	[~] 43	[~] 82	[~] 76
SPORTS	^x 376	^x 331	^x 283	^x 339
CAR	[*] 330	[*] 313	[*] 255	[*] 330
WHERE	[?] 159	[?] 129	[?] 136	[?] 157
BY	^x 264	^x 255	^x 207	^x 245
HE	[~] 146	[~] 94	[~] 95	[~] 116
WON	^x 223	^x 210	^x 185	^x 153
THE	[~] 54	[~] 86	[~] 71	[~] 75
RACE	[*] 418	[*] 397	[*] 245	[*] 485
THE	[~] 114	[~] 90	[~] 90	[~] 99
THREE	[*] 435	[*] 322	[*] 187	[*] 406
RA	^x 219	^x 127	^x 190	^x 255
THER	[~] 135	[~] 118	[~] 129	[~] 82
THAN	[.] 157	[.] 286	[.] 157	[.] 208
THE	[~] 81	[~] 67	[~] 135	[~] 75
TWO	[*] 252	[*] 337	[*] 174	[*] 266
CA	^x 171	^x 167	^x 157	^x 187

Syllable	S1	S2	S3	S4
	~	~	~	~
TE(G)	91	75	120	125
	~	~		
G0	97	105	-	-
	~	~	~	~
RIES	171	99	132	181
	~	~	~	~
OF	70	62	71	76
	~	~	~	~
STU	232	180	183	225
	~	~	~	~
DY	217	180	127	150
	~	~	~	~
SHOW	286	187	183	227
	~	~	~	~
SIGNS	427	416	337	348
	~	~	~	~
OF	82	96	75	54
	~	~	~	~
O	133	142	89	131
	~	~	~	~
VER	70	90	97	90
	~	~	~	~
LA	166	156	127	150
	~	~	~	~
PPING	161	240	187	196
	~	~	~	~
I	138	103	115	112
	~	~	~	~
DID	210	174	163	141
	~	~	~	~
RE	103	123	90	98
	~	~	~	~
SU	175	148	120	143
	~	~	~	~
SCI	88	114	105	105
	~	~	~	~

Syllable	S1	S2	S3	S4
	?	?	?	?
TATE	247	240	168	222
	~	~	~	~
THE	65	73	53	67
	*	*	x	x
PA	195	188	172	171
	~	~	~	~
TIENT	165	186	142	163
	~	~	~	~
I	65	42	70	36
	x	x	*	x
MME	165	150	150	114
	~	~	~	~
DIATE	105	77	153	82
	~	~	~	~
LY	113	69	71	45
	~	~	~	~
BE	115	109	60	120
	x	x	x	x
FORE	191	210	119	270
	~	~	~	~
THE	61	97	134	133
	~	~	~	~
IN	144	107	187	142
	*	*	*	*
JEC	206	159	172	208
	~	~	~	~
TION	140	212	217	186
	^	^	^	^
LOCH	247	196	214	215
	~	~	~	~
NA	126	97	111	140
	*	x	*	*
GAR	346	206	330	376
	~	~	~	~
AND	82	106	114	118

Syllable	S1	S2	S3	S4
LOCH	[?] 285	[?] 195	[?] 279	[?] 208
LE	[*] 211	[*] 173	[*] 172	[*] 202
VEN	[~] 276	[~] 202	[~] 212	[~] 225
ARE	[~] 121	[~] 43	[~] 120	[~] 93
BOTH	[*] 363	[*] 249	[*] 326	^x 328
SCO	^x 208	[*] 240	^x 245	^x 181
TTISH	[~] 175	[~] 210	[~] 118	[~] 163
PLACE	[*] 270	^x 277	[*] 241	^x 253
NAMES	^x 390	^x 318	[*] 432	[*] 323
THE	[~] 61	[~] 52	[~] 54	[~] 51
CHILD'S	^x 513	^x 345	^x 388	^x 412
MEN	^x 189	^x 136	^x 176	^x 171
TAL	[~] 181	[~] 140	[~] 155	[~] 127
PRO	[*] 232	[*] 247	[?] 166	[*] 225
GRESS	[?] 307	[?] 264	[*] 261	[?] 232
IS	[.] 144	[~] 88	[~] 124	[~] 99
LARGE	^x 301	[*] 206	^x 238	^x 330
LY	[~] 183	[~] 85	[~] 112	[~] 105

Syllable	S1	S2	S3	S4
	~	~	~	~
A	39	52	32	80
	x	x	*	*
FFEC	185	200	176	151
	~	~	~	~
TED	185	141	189	193

BY	174	161	180	163
	?	?	?	?
EN	185	249	189	160
	^	^	^	^
VI	157	165	91	150
	~	~	~	~
RON	88	176	75	136
	*	*	*	x
MEN	189	220	184	212
	~	~	~	~
TAL	167	246	180	185
	x	x	x	*
CIR	191	165	172	210
	~	~	~	~
CUM	127	131	135	159
	?	?	~	~
STAN	228	225	168	225
	~	~	~	~
CES	232	187	283	191
	x	x	x	x
HIGH	258	130	200	198
	*	*	*	*
BLOOD	273	224	191	225
	^	^	^	^
PRE	155	150	180	161
	~	~	~	~
SSURE	170	178	136	189

MAY	202	101	97	150

Syllable	S1	S2	S3	S4
	~	~	~	~
BE	116	105	87	91
	*	x	*	*
CAUSED	421	297	392	313
	•	•	•	•
BY	108	172	157	151
	?	~	~	~
E(k)	210	112	135	90
	*	*	*	x
CESS	397	382	384	251
	~	~	~	~
OF	131	80	87	103
	x	*	x	*
SALT	348	337	326	288
	*	x	*	x
IN	133	120	114	88
	?	?	?	?
TAKE	315	273	260	301
	~	~	~	•
IT'S	140	99	125	150
	x	x	x	x
ON	176	138	157	81
	~	~	~	~
LY	153	125	106	88
	*	*	*	*
SOME	315	194	232	322
	x	x	x	*
NEWS	223	278	203	261
	~	~	~	~
CAS	275	282	213	279
	~	~	~	~
TERS	222	152	255	238
	~	~	~	~
WHO	105	102	82	113
	~	~	~	~
PRE	157	124	105	151

Syllable	S1	S2	S3	S4
SENT	x 219	* 180	x 174	x 208
THE	~ 45	~ 82	~ 72	~ 61
NEWS	* 286	x 297	* 366	x 260
IN	~ 90	~ 108	~ 60	~ 78
A	~ 84	~ 54	~ 70	~ 73
LIVE	* 241	* 219	* 216	* 285
LY	~ 97	~ 105	~ 90	~ 86
MA	* 178	* 157	x 142	* 129
NNER	~ 136	~ 126	~ 165	~ 110
IT'S	~ 144	~ 125	~ 152	~ 75
FAIR	x 185	x 212	x 141	x 187
TO	~ 91	~ 76	~ 90	~ 99
SAY	* 408	* 313	* 210	* 289
THAT	~ 157	~ -	~ 111	~ 112
THE	~ 95	~ 105	~ 108	~ 91
AIR	* 217	* 207	* 180	x 206
PORT	? 222	? 225	? 226	? 213
'LL	~ 99	~ 99	~ 86	~ 91

Syllable	S1	S2	S3	S4
BE	135	75	217	118
E	97	69	45	67
CO	105	97	116	129
NO	115 ^x	135 ^x	107 [*]	76 ^x
MI(C)	165	131	133	180
CA	-	-	170	-
LLY	88	137	120	106
GOOD	174 ^x	195 [*]	120 ^x	151 ^x
FOR	82	142	60	112
THE	106	107	52	97
A	168 [*]	146 [*]	172 [*]	198 [*]
RE	118	67	140	90
A	135	103	131	65
BUT	155 [.]	103	131	65
IT	129	101	69	106
'LL	111	78	45	75
AL	208 [*]	150 [*]	66 ^x	165 ^x
SO	187 [?]	217 [?]	161 [?]	157 [?]

Syllable	S1	S2	S3	S4
BE	138	124	97	210
AN	114	67	73	83
EN	150	132	101	69
VI	204	120	117	113
RON	166	117	48	151
MEN	136	195	144	210
TAL	180	110	183	183
NUI	180	122	129	151
SANCE	345	318	266	303
ALL	174	120	172	157
DRUGS	309	444	309	307
ARE	93	103	67	61
CER	172	211	176	188
TAIN	106	105	97	71
LY	75	120	108	101
HARM	270	213	222	277
FUL	196	200	226	155
IN	103	90	52	67

Syllable	S1	S2	S3	S4
	~	~	~	~
A	91	52	62	78
	*	*	?	*
DI	221	221	114	202
	?	?	*	?
RECT	281	232	225	228
	?	~	~	x
OR	174	125	51	226
	~	~	~	~
IN	136	129	90	121
	?	?	?	?
DI	159	85	157	135
	x	x	x	x
RECT	219	227	303	189
	*	*	*	*
WAY	210	243	322	193
	~	~	~	~
IT	86	38	46	76
	~	~	~	~
WAS	131	123	126	91
	*	*	*	*
SHO	225	141	163	144
	~	~	~	~
CKING	212	240	135	196
	~	~	~	~
TO	95	107	69	91
	x	x	x	x
FIND	273	182	180	253
	?	?	?	?
MY	135	167	142	155
	x	x	x	x
SELF	253	255	236	283
	~	~	~	~
AT	93	81	75	88
	*	*	*	*
MEAL	260	227	187	315

Syllable	S1	S2	S3	S4
TIME	[?] 335	[?] 365	[?] 290	[?] 403
THE	[~] 54	[~] 97	[~] 74	[~] 84
ON	^x 181	^x 126	[*] 150	^x 166
LY	[~] 125	[~] 107	[~] 93	[~] 129
PER	^x 219	^x 236	^x 196	^x 235
SON	[~] 144	[~] 174	[~] 129	[~] 121
AT	[~] 84	[~] 48	[~] 95	[~] 74
THE	[~] 82	[~] 82	[~] 45	[~] 67
TA	[*] 217	[*] 221	[*] 200	[*] 219
BLE	[~] 141	[~] 198	[~] 174	[~] 149
HE	[.] 157	[~] 90	[~] 97	[~] 105
PROVED	[*] 366	[*] 436	[*] 307	^x 322
LONG	[.] 168	^x 258	^x 279	[.] 174
A	[~] 70	[~] 75	[~] 82	[~] 82
GO	[*] 266	[*] 333	[*] 146	[*] 221
THAT	[~] 106	[~] 76	[~] 90	[~] 128
THIS	[.] 150	[.] 151	[.] 157	[.] 166
CON	^x 206	^x 243	^x 195	^x 253

Syllable	S1	S2	S3	S4
CEPT	[?] 307	[?] 223	[?] 267	[?] 221
WAS	125	88	97	142
FAUL	[*] 210	[*] 275	[*] 187	[*] 159
TY	150	210	210	180
THE	54	39	52	60
NOTE	^x 215	^x 167	^x 152	^x 155
HE	[.] 163	121	111	106
LEFT	[*] 300	[*] 271	[*] 268	[*] 216
DOES	-	^x 154	^x 129	^x 153
N'T	106	90	106	120
CLEAR	^x 249	[*] 256	[*] 217	^x 200
LY	102	73	111	89
SPE	[*] 210	^x 189	^x 185	[*] 202
CI	110	137	135	84
FY	[?] 271	[?] 262	[?] 243	[?] 234
WHERE	^x 200	^x 127	^x 226	^x 170
HE	135	67	96	126
WAS	151	120	116	135

Syllable	S1	S2	S3	S4
HEA	* 162	* 135	* 111	* 111
DING	~ 123	~ 213	~ 148	~ 163
IT	~ 75	~ 69	~ 61	~ 65
WAS	~ 120	~ 97	~ 90	~ 105
AN	~ 84	~ 111	~ 68	~ 75
UN	~ 136	x 144	~ 121	~ 135
U(S)	* 249	* 285	* 223	x 264
SU	- ~	- ~	- ~	- ~
A	~ 73	~ 91	~ 133	~ 97
LLY	~ 76	~ 91	~ 61	~ 97
DARK	x 300	x 313	* 264	* 268
NIGHT	x 262	x 301	x 249	x 258
YOU'D	~ 180	~ 91	~ 90	~ 186
BE	x 141	x 90	x 89	x 151
TTER	~ 66	~ 90	~ 76	~ 121
RE	~ 118	~ 64	~ 62	~ 82
TURN	x 268	x 204	x 246	x 282
THE	~ 76	~ 45	~ 73	~ 45

Syllable	S1	S2	S3	S4
	*	*	*	*
TAPE	241	180	187	223
	~	~	~	~
RE	82	63	108	73
	^	^	^	^
COR	204	203	185	189
	~	~	~	~
DER	136	90	153	144
	~	~	~	~
AND	136	110	78	95
	~	~	~	~
	x	x	x	x
BRING	168	172	215	253
	~	~	~	~
THE	67	53	46	52
	~	~	~	~
	*	*	*	*
TURN	270	290	230	264
	~	~	~	~
TA	193	221	169	162
	~	~	~	~
BLE	129	159	179	172
	~	~	~	~
HIS	120	117	127	140
	~	~	~	~
CHA	186	150	145	149
	~	~	~	~
RAC	116	67	97	88
	~	~	~	~
TE	-	-	52	-
	~	~	~	~
	x	x	x	x
(T)RIS	280	214	172	237
	~	~	~	~
TI(C)	101	129	141	187
	~	~	~	~
CA	90	-	-	-
	~	~	~	~
LLY	72	108	172	133
	~	~	~	~

Syllable	S1	S2	S3	S4
SAR	[?] 223	[?] 224	[?] 174	[?] 210
CAS	^x 233	[*] 294	[*] 292	^x 219
TIC	[~] 117	[~] 137	[~] 108	[~] 135
IM	[~] 112	[~] 94	[~] 117	[~] 123
PRE	[*] 189	[*] 195	[*] 141	[*] 187
SSIONS	[~] 270	[~] 213	[~] 385	[~] 331
AL	^x 211	^x 187	^x 197	^x 136
WAYS	[~] 129	[?] 255	[~] 187	[~] 155
FA	^x 136	^x 177	[*] 165	^x 125
SCI	[~] 118	[~] 114	[~] 117	[~] 91
NATE	[?] 183	[?] 150	[?] 147	[?] 223
THE	[~] 52	[~] 90	[~] 33	[~] 90
AU	[*] 135	[*] 163	^x 141	[*] 135
DI	[~] 88	[~] 102	[~] 84	[~] 97
ENCE	[~] 300	[~] 315	[~] 326	[~] 211
IF	[~] 129	[~] 80	[~] 112	[~] 110
YOU	[~] 82	[~] 110	[~] 37	[~] 88
UN	[~] 168	[~] 116	[~] 106	[~] 172

Syllable	S1	S2	S3	S4
LOAD	^x 255	^x 262	^x 253	^x 240
THE	[~] 73	[~] 45	[~] 60	[~] 66
TRUCK	^x 277	^x 232	[*] 275	^x 226
PIECE	[*] 283	[*] 294	[*] 288	[*] 286
MEAL	[?] 215	[?] 213	[?] 202	[?] 217
TO	[~] 99	[~] 75	[~] 56	[~] 63
NIGHT	[*] 277	[*] 285	[*] 280	[*] 232
WE	[~] 82	[~] 60	[~] 67	[~] 61
CAN	[~] 120	[~] 146	[~] 145	[~] 148
START	^x 307	^x 273	^x 288	^x 303
BUIL	[*] 187	^x 187	[*] 174	^x 195
DING	[~] 148	[~] 157	[~] 204	[~] 208
TO	[~] 103	[~] 78	[~] 107	[~] 76
MO	[*] 172	[*] 150	[*] 132	[*] 150
RROW	[?] 136	[?] 150	[?] 157	[?] 129
THE	[~] 99	[~] 75	[~] 66	[~] 75
AC	^x 150	^x 142	[*] 123	^x 99
TU	[~] 185	[~] 96	[~] 240	[~] 185

Syllable	S1	S2	S3	S4
AL	140	105	114	82
RANGE	418	315	187 ^x	223 [*]
OF	99	45	75	67
SPE	199	181	157	187
CI	93	122	105	110
FI	111	74	75	67
CA	189	194	161	206
TIONS	406	248	355	275
IS	90	85	67	76
TO	103	69	81	73
BE	113	112	84	105
MO	150	165	156 ^x	133 [*]
DI	116	105	103	97
FIED	290 [?]	322 [?]	309 [?]	307 [?]
ON	208 [.]	74	132 [.]	98
ALL	343 [*]	232 ^x	300 [*]	185 ^x
FU	121 ^x	118 ^x	166 ^x	163 ^x
TURE	156	125	132	150

Syllable	S1	S2	S3	S4
	*	*	*	*
MO	183	147	148	129
	~	~	~	~
DELS	230	255	216	230
	~	~	~	~
IT	90	67	62	73
	~	~	~	~
WAS	127	153	138	126
	~	~	~	~
THE	112	120	78	110
	*	*	*	*
RENT	217	238	183	241
	~	~	~	~
I	105	139	65	140
	x	x	x	x
AR	258	168	185	170
	?	?	?	?
GUED	182	182	210	178
	~	~	~	~
WITH	146	96	90	73
	~	~	~	~
THE	76	78	62	51
	*	*	*	*
LAND	252	313	210	241
	?	?	?	?
LORD	203	105	157	120
	~	~	~	~
A	61	46	43	41
	x	x	x	x
BOUT	240	287	231	187
	~	~	~	~
THE	82	52	67	46
	~	~	~	~
FUN	244	193	145	170
	~	~	~	~
DA	60	64	51	51

Syllable	S1	S2	S3	S4
MEN	^x 230	[*] 162	[*] 158	^x 139
TALS	[~] 270	[~] 182	[~] 307	[~] 144
OF	[~] 75	[~] 61	[~] 78	[~] 67
RE	[~] 112	[~] 84	[~] 97	[~] 87
LI	[*] 138	^x 110	^x 91	^x 120
GIOUS	[~] 166	[~] 97	[~] 178	[~] 127
BE	[~] 142	[~] 121	[~] 112	[~] 69
LIEF	^x 247	^x 256	^x 211	[*] 217
CAN'T	^x 275	-	-	^x 241
BE	[~] 130	[~] 75	[~] 92	[~] 101
SUB	[~] 127	[~] 120	[~] 140	[~] 144
JEC	^x 196	[*] 167	^x 208	[*] 187
TED	[~] 142	[~] 157	[~] 155	[~] 172
TO	[~] 144	[~] 82	[~] 176	[~] 95
EM	[~] 118	[~] 135	[~] 108	[~] 129
PI	[*] 150	^x 142	[*] 144	[*] 140
RI	[~] 73	[~] 96	[~] 56	[~] 73
CAL	[~] 182	[~] 58	[~] 146	[~] 168

Syllable	S1	S2	S3	S4
RE	117	112	90	82
SEARCH	450 ^x	415 [*]	414 ^x	337 [*]
IT'S	193 [.]	107	144	150
THE	81	81	53	87
BLACK	247 ^x	240 [*]	291 ^x	222 [*]
HOME	307 [*]	231 [*]	230 ^x	243 [*]
LANDS	390 [?]	279 [?]	299 [?]	333 [?]
THAT	82	90	87	72
ARE	148	67	77	60
CLEAR	241 ^x	286 ^x	255 [*]	248 ^x
LY	118	125	108	106
BE	168 ^x	136 ^x	93 ^x	138 ^x
ING	97	67	67	127
DI	93	100	69	127
SCRI	187 [*]	171 [*]	180 ^x	202 [*]
MI	73	57	52	58
NA	142 [?]	135 [?]	92 [?]	150 [?]
TED	127	112	108	99

Syllable	S1	S2	S3	S4
	~	~	~	~
A	65	52	80	86
	x	x	x	x
GAINST	330	369	339	279
	~	~	~	~
IT'S	129	90	73	142
	~	~	~	~
THE	133	60	84	73
	*	*	*	*
UN	217	154	111	112
	~	~	~	~
DER	110	90	83	61
	~	~	~	~
DOGS	418	227	457	309
	x	.	.	.
NOT	208	170	119	173
	~	~	~	~
THE	84	80	67	69
	~	~	~	~
DE	95	87	82	95
	x	x	x	x
FEN	208	199	144	165
	~	~	~	~
DING	151	129	135	151
	*	*	*	*
CHAM	240	234	221	225
	~	~	~	~
PIONS	442	213	446	296
	.	~	.	~
WHO	165	80	163	116
	~	~	~	~
ARE	112	69	69	52
	x	x	*	x
U(S)	228	170	181	215
	-	-	-	-
SU	-	-	-	-

Syllable	S1	S2	S3	S4
A	-	-	-	-
LLY	140	69	112	65
UN	^x 163	^x 82	^x 150	^x 99
DER	95	84	95	84
PRE	*185	*172	^x 163	*181
SSURE	159	121	163	136
IT	114	76	82	73
WAS	^x 230	95	110	112
HIS	^x 238	86	121	[.] 165
CHA	217	150	103	166
RAC	111	72	103	77
TE	-	-	-	-
(T)RIS	^x 255	^x 157	^x 159	^x 210
TIC	144	117	150	159
SAR	*262	*215	*255	*256
CA	174	185	142	159
SM	228	159	166	189
THAT	121	70	75	106

Syllable	S1	S2	S3	S4
	~	~	~	~
CON	159	142	172	99
	x	x	x	x
CEALED	333	320	328	301
	~	~	~	~
HIS	156	129	136	151
	^	^	^	^
UN	125	136	93	106
	~	~	~	~
DER	112	106	82	73
	x	x	x	x
LY	133	103	128	166
	~	~	~	~
ING	155	138	166	99
	*	*	*	*
SE	233	197	208	111
	~	~	~	~
RI	80	60	67	76
	~	~	~	~
OUS	157	129	140	112
	~	~	~	~
NESS	260	230	262	205
	~	~	~	~
A	99	54	49	53
	?	?	?	?
HAR	213	232	142	151
	x	x	x	x
MO	195	241	124	118
	~	~	~	~
NIOUS	249	180	200	189
	*	?	x	~
BOU	285	187	127	129
	?	x	?	*
QUET	264	310	201	343
	~	~	~	~
OF	97	76	63	58

Syllable	S1	S2	S3	S4
AR	151	127	105	121
TI	91	41	83	105
FI	113 ^x	121 ^x	101 ^x	99 ^x
CIAL	178	174	157	165
FLOW	326 [*]	275 [*]	283 [*]	286 [*]
ERS	156	120	136	121
WILL	141 [.]	98	84	115
MAKE	187 ^x	125 ^x	112 ^x	129 ^x
A	72	61	50	54
PLEA	247 ^x	253 [*]	167 [*]	188 ^x
SANT	157	146	166	136
GIFT	320 [*]	292 [*]	328 ^x	290 [*]
THE	90	88	37	66
A	111 ^x	99 [*]	142 [*]	112 ^x
VA	78	82	88	90
LANCHE	328 [?]	298 [?]	228 [?]	248 [?]
YOU'RE	144 [.]	84 [.]	71 [.]	88 [.]
TAL	211 [*]	195 ^x	166 ^x	167 [*]

Syllable	S1	S2	3	S4
	~	~	~	~
KING	112	96	110	136
	~	~	~	~
A	52	53	45	46
	~	~	~	~
BOUT	^x 264	[*] 241	^x 213	^x 232
	~	~	~	~
WAS	[.] 155	90	56	72
	~	~	~	~
MEN	^x 208	^x 181	[*] 178	^x 172
	~	~	~	~
TIONED	180	113	262	144
	~	~	~	~
IN	121	81	84	97
	~	~	~	~
THE	63	58	75	67
	~	~	~	~
PA	^x 178	^x 204	^x 181	^x 151
	~	~	~	~
PER	135	108	136	91
	~	~	~	~
YES	[*] 172	[*] 223	[*] 170	[*] 110
	~	~	~	~
TER	118	73	103	112
	~	~	~	~
DAY	[?] 210	[?] 195	[?] 153	[?] 140
	~	~	~	~
THE	88	58	58	103
	~	~	~	~
AR	[*] 112	[*] 165	[*] 136	[*] 140
	~	~	~	~
CHI	120	84	66	91
	~	~	~	~
TECT	[?] 268	[?] 211	[?] 241	[?] 208
	~	~	~	~
WHO	[.] 140	61	103	82

Syllable	S1	S2	3	S4
WAS	125	84	88	103
AC	^x 150	^x 121	^x 116	^x 133
TING	144	129	148	151
AS	84	80	114	78
A	86	73	48	65
GUIDE	[*] 405	[*] 373	[*] 444	[*] 375
A	75	50	42	66
COM(P)	^x 271	^x 202	[*] 136	^x 197
PA	-	105	88	96
NIED	118	165	127	144
US	[*] 226	[*] 236	^x 232	[*] 168
RIGHT	^x 232	^x 159	^x 240	^x 217
ROUND	^x 247	^x 181	^x 225	^x 253
THE	60	43	41	50
BUIL	[*] 144	[*] 376	[*] 174	[*] 172
DING	150	298	120	202
IT	40	48	37	84
WAS	^x 87	^x 125	^x 150	^x 157

Syllable	S1	S2	S3	S4
N'T	97	80	71	90
SO	99 [.]	88 [.]	129 [.]	103 [.]
MUCH	219 [.]	159 [.]	178 [.]	148 [.]
THE	91	84	50	76
PRO	73	118	116	105
NUN	157	144	157	204
CI	98	125	103	103
A	198	131	126	164
TION	380	187	303	345
AS	158 [.]	82	101	69
THE	90	71	61	80
SPE	292	219	256	256
LLING	163	144	165	195
OF	84	95	76	81
RUMP	194	153	243 ^x	170
TI	110	112	106	114
TUM	334 ^x	211 [*]	247 [?]	318 ^x
THAT	91	105	73	88

Syllable	S1	S2	S3	S4
HE	116	95	67	91
FOUND	^x 270	^x 286	^x 264	^x 171
A	51	48	45	44
BIT	136 [.]	35	99	144 [.]
UN	106	106	125	129
U(S)	[*] 262	[*] 204	[*] 210	[*] 219
SU	-	-	-	-
(U)AL	127	133	133	112
IT'S	180 [.]	120	166 [.]	166 [.]
THE	142	88	73	45
MIL	[?] 194	[?] 172	[?] 144	[?] 166
TO	^x 75	^x 148	^x 142	^x 149
NIC	258	129	144	154
STYLE	[*] 339	[*] 485	[*] 448	[*] 555
NOT	159 [.]	118 [.]	140 [.]	^x 213
THE	90	78	58	54
VO	88	133	60	103
CAB	[*] 234	[*] 241	[*] 167	[*] 268

Syllable	S1	S2	S3	S4
U	71	54	108	77
LA	125	67	90	101
RY	144	123	150	131
YOU	129	73	63	56
SHOULD	191	112	135	133
PAY	161	123	-	172
A	63	52	54	43
TEN	211	172	186	198
TION	153	151	187	159
TO	180	174	238	213
IN	142	133	86	108
PA	172	140	163	197
RA	75	75	71	116
DISE	258	196	204	110
LOST	339	281	418	264
IT'S	159	112	110	120
THE	90	76	75	73
GO	185	157	163	181

Syllable	S1	S2	S3	S4
VERN	136	90	114	127
MENT	246	110	120	181
THAT	84	71	68	83
ARE	118	84	95	54
FEE	^x 152	^x 131	^x 135	^x 157
LING	157	118	123	133
THE	65	67	60	60
PRE	^x 200	[*] 181	[*] 172	[*] 180
SSURE	150	142	171	152
AT	70	90	90	113
THE	73	69	52	46
MO	[*] 200	[*] 150	[*] 120	[*] 127
MENT	174	181	193	136
SPORTS	[*] 400	[*] 366	[*] 345	[*] 375
COM	174	142	144	159
PE	82	54	83	68
TI	^x 133	^x 120	[*] 166	^x 153
TIONS	292	218	337	294

Syllable	S1	S2	S3	S4
HAD	123	166 [.]	84	143 [.]
AT	95	88	112	91
FIRST	316 [*]	345 [*]	418 [*]	249 ^x
A	91	61	61	53
RE	105	157	83	106
LI	129 [*]	91 [*]	112 [*]	98 [*]
GIOUS	219	316	277	219
O	165	129	135	120
RI	114	76	65	99
EN	116	99	45	52
TA	202 ^x	202 ^x	200 ^x	211 ^x
TION	165	159	215	253
THE	64	56	45	82
PO	238 ^x	195 [*]	223 [*]	258 [*]
EM	106	120	129	142
DOES	178 ^x	176 ^x	142 ^x	159 ^x
N'T	78	83	82	84
HAVE	198 ^x	292 ^x	176 ^x	163 ^x

Syllable	S1	S2	S3	S4
	~	~	~	~
THE	81	105	78	82
	*	*	x	x
REG	161	204	156	180
	~	~	~	~
U	71	75	67	84
	~	~	~	~
LAR	131	144	86	90
	?	?	?	?
PEN	176	210	172	200
	x	*	*	*
TA	163	195	187	157
	~	~	~	~
ME	83	69	91	84
	~	~	~	~
TER	150	127	108	168
	x	*	x	*
RHY	114	127	82	138
	~	~	~	~
THM	112	105	129	144
	~	~	~	~
YOU	112	105	193	114
	x	x	x	x
MIGHT	172	198	211	186
	~	~	~	~
EX	150	105	136	149
	*	*	*	*
PECT	238	286	266	271
	~	~	~	~
IT	40	31	43	61
	~	~	~	~
HAS	151	121	76	157
	~	~	~	~
A	54	45	45	54
	*	*	*	*
LOT	225	174	125	165

Syllable	S1	S2	S3	S4
	~	~	~	~
T0	71	114	118	97
	x	x	x	x
D0	238	165	226	180
	~	~	~	~
WITH	78	121	121	105
	?	?	?	?
NEW	196	217	101	130
	*	x	x	x
TON	266	323	210	210
	~	~	~	~
IAN	181	218	181	158
	x	x	x	x
LAWS	238	324	234	255
	~	~	~	~
OF	105	69	93	73
	*	*	*	*
GRA	210	234	172	187
	~	~	~	~
VI	71	72	88	62
	~	~	~	~
TY	136	195	126	198
	~	~	~	~
THE	105	54	61	67
	*	x	*	x
BO	241	174	174	159
	~	~	~	~
NY	181	144	142	120
	x	x	x	x
FUN	155	193	187	174
	~	~	~	~
DA	67	76	106	75
	~	~	~	~
MENTS	240	200	268	309
	~	~	~	~
OF	84	50	76	150

Syllable	S1	S2	S3	S4
THE	110	76	129	105
SE	154	136	112	142
VERE	186 ^x	150 ^x	172 [*]	147 ^x
LY	131	116	153	148
MAL	249 ^x	178 [^]	167 [^]	303 ^x
NOU	159 ^x	174 ^x	121 ^x	131 ^x
RISHED	191	157	185	202
CHILD	243 [*]	202 [*]	238 [*]	251 [*]
REN	217	136	202	175
LOOKED	277 ^x	113 [.]	204 ^x	157 [.]
AL	260 ^x	148 ^x	150 ^x	121 ^x
MOST	202 [?]	200 [?]	138 [?]	171 [?]
LIKE	186 [.]	135 [.]	159 [.]	159 [.]
SKE	232 [*]	200 [*]	181 [*]	225 [*]
LE	99	76	103	90
TONS	356	354	286	361
THE	69	67	90	105
OLD	341 [*]	345 [*]	234 ^x	230 ^x

Syllable	S1	S2	S3	S4
RUM	[?] 197	[?] 172	[?] 148	[?] 168
BUS	^x 206	[*] 21	[*] 241	^x 134
TIOUS	[~] 272	[~] 168	[~] 202	[~] 217
LI	^x 208	[*] 247	^x 211	[*] 240
ON	[~] 226	[~] 146	[~] 165	[~] 142
HAS	[.] 172	[~] 125	[~] 105	[.] 172
AT	[~] 90	[~] 163	[~] 101	[~] 91
LAST	[*] 352	[*] 405	^x 346	[*] 352
MET	[.] 142	[.] 131	^x 205	[.] 112
ITS	[~] 146	[~] 140	[~] 135	[~] 123
MATCH	[*] 331	[*] 429	[*] 444	[*] 335
SHE	^x 217	[~] 146	[~] 97	[.] 140
WAS	[.] 135	[.] 146	[~] 97	[.] 140
STUNNED	[*] 510	[*] 397	[*] 481	[*] 371
AT	[~] 118	[~] 52	[~] 86	[~] 88
BE	[~] 110	[~] 73	[~] 69	[~] 129
CO	^x 163	^x 249	^x 140	^x 180
MING	[~] 105	[~] 260	[~] 90	[~] 176

Syllable	S1	S2	S3	S4
	~	~	~	~
A	61	69	58	32
	^	^	^	^
MILL	208	213	136	170
	~	~	~	~
IO	97	56	73	81
	~	~	~	~
NAI	246 ^x	174 ^x	174 ^x	95 ^x
	~	~	~	~
RESS	220 [?]	234 [?]	283 [?]	111 [~]
	~	~	~	~
O	118	90	88	75
	~	~	~	~
VER	97	69	108	81
	~	~	~	~
NIGHT	245 [*]	283 [*]	246 [*]	211 [*]
	~	~	~	~
THEIR	181 [.]	103 [.]	127 [.]	135 [.]
	~	~	~	~
SO	232 [*]	188 [*]	196 [*]	202 [*]
	~	~	~	~
CIA	166	112	99	82
	~	~	~	~
LI	69	88	84	76
	~	~	~	~
SM	136	133	226	202
	~	~	~	~
WAS	155 [.]	67	91	99
	~	~	~	~
A	60	42	54	53
	~	~	~	~
COM	187	188	211	138
	~	~	~	~
BI	60	67	45	61
	~	~	~	~
NA	170 ^x	172 ^x	135 ^x	141 ^x
	~	~	~	~

Syllable	S1	S2	S3	S4
TION	315	121	172	118
OF	150	90	78	75
NA(TIO)	307	345	277	260
TIO	-	-	-	-
NA	84	118	82	95
LI	150	118	91	103
SM	200	141	195	178
AND	163	108	54	75
RE	112	82	99	82
PUB	195	204	183	181
LI	103	56	60	69
CA	114	97	84	97
NI	90	110	97	98
SM	181	126	202	200
THEY('RE)	142	98	115	172
'RE	-	-	-	180
AD	106	136	84	136
MI	133	131	91	97

Syllable	S1	S2	S3	S4
	~	~	~	~
NI	92	75	76	84
	~	~	~	~
STRA	144	154	120	178
	~	~	~	~
TIVE	131	159	99	170
	~	~	~	~
DI	^x 127	^x 90	[*] 114	^x 150
	~	~	~	~
FFI	52	110	70	96
	~	~	~	~
CUL	99	120	112	142
	~	~	~	~
TIES	166	232	263	133
	~	~	~	~
IN	90	84	61	84
	~	~	~	~
THE	52	84	81	85
	~	~	~	~
FIRST	[*] 292	[*] 247	[*] 255	[*] 234
	~	~	~	~
PLACE	[*] 262	^x 322	^x 345	^x 277
	~	~	~	~

Appendix P1

Production and non-production-biased judgements of the
place of primary accents in words with wrongly placed
accents for two non-native informants (S11 and S12)

Informant	Word	Correct (C) or Incorrect (X) Judgement	Production-biased Judgement (YES) or not (NO)
S11	TEMPORARY	C	-
	CATEGORY	C	-
	PENTAMETER	C	-
	PRESENT (v)	C	-
	COUNTENANCED	X	NO
	ADEQUATE	X	YES
	CONCEPT	X	-
	ACCOUNT	C	-
	SENTIMENT	C	-
	RESUSCITATE	C	-
S12	TEMPORARY	C	-
	CATEGORY	X	NO
	PENTAMETER	C	-
	PRESENT (v)	X	YES
	COUNTENANCED	X	YES
	ADEQUATE	X	YES
	MEALTIME	X	YES
	ARTIFICIAL	C	-
	RELENTLESSLY	X	YES
	SENTIMENTALLY	X	YES
	CHARACTERISTICALLY	X	YES

Appendix P2Ai

Judgements by native informants of the place of tonic accent in Type

A words

Informants	S1	S2	S3	S4	S5	S6	S7	S8
EXERCISE	C	C	C	C	C	C	C	C
\MENTALITY	C	C	C	C	C	XO	C	XN
COCA\COLA	C	C	C	C	C	XN	C	XN
ARTIFICIAL	C	C	C	C	XN	XO	C	C
\ADULT	C	C	C	C	C	C	C	C
\INTERDEPEND	C	C	C	C	XO	XN	XO	XN
TRIUMPHANT	C	C	C	C	C	XO	C	XN
AIR\PORT	C	C	C	C	C	C	C	C
STOP-WATCH	C	C	C	C	C	C	C	C
RANSACK	C	C	C	C	C	C	C	C
CHARACTERISTICALLY	C	C	C	C	XO	XO	XO	XN
\CONVERSELY	C	C	C	C	XO	XO	C	C
CON\VERSELY	C	C	C	C	XO	C	C	XN
MATHEMATICS	C	C	C	C	XN	XN	C	XN
MISSILE	C	C	C	C	X	X	C	X
CON\SULTATION	C	C	C	C	C	C	C	C
SACRIFICE	C	C	C	C	C	C	C	C

(C correct judgement, X incorrect judgement, XO incorrect judgement as a result of opting for another prominent syllable in the word, XN incorrect judgement as a result of opting for a non-prominent syllable)

(continued below)

(continued from above)

Informant	S1	S2	S3	S4	S5	S6	S7	S8
SENTIMENTALLY	C	C	C	C	C	XN	C	C
\AMATEUR	C	C	C	C	XN	XN	XO	X
AMA\TEUR	C	C	C	C	C	C	C	C
RUNNER-UP	C	C	C	C	C	XN	C	C
HABITAT	C	C	C	C	XN	XN	C	XN
SEPARATE	C	C	C	C	XO	XN	C	XN
GELA\TINE	C	C	C	C	C	XN	C	XN
\GELATINE	C	C	C	C	C	XN	C	XO
MEALTIME	C	C	C	C	C	C	C	C
PESTICIDE	C	C	C	C	XN	XN	C	XN
DI\RECT	C	C	C	C	C	C	C	C
\PERSEVERE	C	C	C	C	C	C	XO	XN
BENE\FACTION	C	C	C	C	C	XO	C	XN
\BENEFACTION	C	C	C	C	C	XN	C	XN
COM\POST	C	C	C	C	C	X	C	X
PENTAMETER	C	C	C	C	C	XO	C	XN
\INCENSE	C	C	C	C	C	X	C	C
SIGNIFY	C	C	C	C	C	XO	C	C
COMBAT	C	C	C	C	XO	XO	C	C
ESSAY	C	C	C	C	X	X	C	C
EVIDENTIAL	C	C	C	C	C	C	C	C
MOUTH-ORGAN	C	C	C	C	C	C	C	XN
\PREMATURE	C	C	C	C	OX	XN	C	C
PREMA\TURE	C	C	C	C	C	XN	C	C
\UNDERSTAND	C	C	C	C	XO	C	XO	C

(continued below)

(continued from above)

Informant	S1	S2	S3	S4	S5	S6	S7	S8
CONCEPT	C	C	C	C	C	X	X	C
CA\TASTROPHIC	C	C	C	C	XN	XN	XN	XO
ESSEX	C	C	C	C	C	X	C	C
LETTER-BALANCE	C	C	C	C	C	XN	C	XN
MATRIMONIAL	C	C	C	C	XN	XN	C	C
DIMENSION	C	C	C	C	C	C	C	XN
\COMPLIMENT	C	C	C	C	C	XN	C	XO
COMPLI\MENT	C	C	C	C	C	XN	C	XN
SUBSTANTIATION	C	C	C	C	XN	XO	XO	XO
MULTIPLY	C	C	C	C	C	XN	C	C
\HOGMANAY	C	C	C	C	C	C	C	C
HOGMA\NAY	C	C	C	C	C	XN	C	XN
TAXI-CAB	C	C	C	C	C	C	C	C
CAPSIZE	C	C	C	C	C	C	C	X
ESCORT	C	C	C	C	X	X	C	X
EASTER-DAY	C	C	C	C	C	XN	C	C
PROCESS	C	C	C	C	X	C	C	C
EDUCATE	C	C	C	C	XN	C	C	XN
NECESSITATE	C	C	C	C	C	C	C	XN
SIGNIFICANCE	C	C	C	C	XO	XO	XO	C
RESUSCITATE	C	C	C	C	C	C	C	C
MULTIPLICITY	C	C	C	C	C	XN	C	C
GOAL-POST	C	C	C	C	C	C	C	C
A\CCUSATION	C	C	C	C	C	C	C	C
HARM\FUL	C	C	C	C	C	C	C	C

(continued below)

(continued from above

Informant	S1	S2	S3	S4	S5	S6	S7	S8
HARM\ LESS	C	C	C	C	C	C	X0	X0
COMPREHEND	C	C	C	C	XN	C	C	XN
\REPREHEND	C	C	C	C	C	C	C	XN
\IMPORTED	C	C	C	C	C	C	C	C
\DEPORTED	C	C	C	C	C	C	C	C

(END)

Judgements by non-native informants of the place of tonic accent in
Type A words

Informants	S9	S10	S11	S12	S13	S14	S15	S16
EXERCISE	C	C	C	X0	C	X0	C	C
\MENTALITY	C	C	X0	X0	C	C	C	X0
COCA-COLA	C	C	C	C	C	C	C	X0
ARTIFICIAL	C	C	XN	C	C	C	C	XN
\ADULT	C	X	X	C	X	X	C	X
\INTERDEPEND	C	C	XN	XN	XN	C	X0	X0
TRIUMPHANT	X0	C	C	XN	C	C	X0	X0
AIR\PORT	C	X	C	C	C	C	C	C
STOP-WATCH	C	X	C	C	C	X	C	C
RANSACK	C	X	X	X	C	C	C	C
CHARACTERISTICALLY	C	XN	XN	XN	C	C	C	XN
\CONVERSELY	C	C	C	X0	X0	C	X0	C
CON\VERSELY	C	X0	C	C	C	C	C	X0
MATHEMATICS	C	X0	XN	C	C	X0	C	XN
MISSILE	X	X	C	X	X	X	X	X
CON\SULTATION	C	X0	X0	X0	C	C	C	C
SACRIFICE	XN	C	XN	XN	XN	C	C	XN

(C correct judgement, X incorrect judgement, X0 incorrect judgement as a result of opting for another prominent syllable in the word, XN incorrect judgement as a result of opting for a non-prominent syllable)

(Continued below)

(Continued from above)

Informants	S9	S10	S11	S12	S13	S14	S15	S16
SENTIMENTALLY	C	C	XN	XN	C	C	XN	XN
\AMATEUR	XO	XO	C	C	XO	XO	C	C
AMA\TEUR	C	C	C	XN	C	C	C	C
RUNNER-UP	XO	C	C	C	XN	XO	XN	C
HABITAT	XO	XN	XN	XO	XN	XO	C	XN
SEPARATE	C	C	XN	C	XN	XO	XO	XN
GELA\TINE	C	C	C	XN	C	C	C	C
\GELATINE	C	C	XO	XO	C	C	C	C
MEALTIME	C	C	XO	XO	C	C	C	C
PESTICIDE	C	C	XN	XO	C	C	C	C
DI\RECT	C	C	C	X	C	X	C	X
\PERSEVERE	C	C	C	XN	C	XO	XN	C
BENE\FACTION	XO	C	C	XO	C	C	XO	C
BENEFACTION	C	C	XO	XN	C	C	C	C
COM\POST	C	C	C	C	C	C	C	C
PENTAMETER	C	XO	C	C	XO	C	C	C
\INCENSE	C	C	C	C	C	C	C	X
SIGNIFY	C	C	C	XN	C	XN	C	C
COMBAT	C	C	C	X	X	C	X	C
ESSAY	XO	C	C	X	X	X	X	X
EVIDENTIAL	C	C	C	XN	C	XN	XO	XN
MOUTH-ORGAN	XN	XO	C	XO	C	C	XO	C
\PREMATURE	XN	XO	C	C	C	C	C	C
PREMA\TURE	C	XN	XO	C	XN	XO	XO	C
\UNDERSTAND	XO	C	C	XO	XN	XN	XO	C

(continued below)

(continued from above)

Informants	S9	S10	S11	S12	S13	S14	S15	S16
CONCEPT	C	C	X	X	C	C	C	C
CA\ TASTROPHIC	C	C	XO	XO	C	XO	XN	C
ESSEX	C	C	X	C	X	X	C	C
LETTER-BALANCE	C	XO	XN	XO	XN	XO	XO	XO
MATRIMONIAL	C	C	XN	XO	XN	XO	C	XN
DIMENSION	C	C	XN	XN	XO	XN	XO	XO
\COMPLIMENT	C	C	C	C	XN	C	C	C
COMPLI\MENT	C	XO	XN	XN	XN	C	XO	XN
SUBSTANTIATION	X	C	XN	C	XO	XO	XN	XO
MULTIPLY	C	C	XN	XN	XN	XO	C	C
\HOGMANAY	C	C	XO	C	C	XO	C	XO
HOGMA\NAY	C	C	XN	XN	XN	C	C	XN
TAXI-CAB	C	C	XN	XO	C	C	C	C
ESCORT	X	C	C	C	X	X	X	C
EASTER-DAY	XO	XO	C	XN	XO	C	C	C
PROCESS	C	C	C	C	X	C	C	C
EDUCATE	C	C	C	C	C	C	C	C
NECESSITATE	XN	XN	XN	XO	C	C	C	XN
SIGNIFICANCE	XO	XO	XO	XO	XN	XN	XN	XO
RESUSCITATE	C	XN	C	XN	C	C	XO	C
MULTIPLICITY	C	XN	C	XN	C	XO	XN	C
GOAL-POST	C	X	X	C	X	X	C	C
A\ CCUSATION	C	C	C	C	C	C	C	C
HARM\FUL	C	C	C	XO	C	C	C	C
HARM\LESS	C	C	C	C	C	X	X	C

(continued below)

(continued from above)

Informants	S9	S10	S11	S12	S13	S14	S15	S16
\COMPREHEND	C	C	XN	C	XN	C	C	C
\REPREHEND	C	C	C	XN	XO	XO	C	C
\IMPORTED	C	XO	C	C	C	XO	C	C
\DEPORTED	C	C	XO	XN	XO	C	C	C

(END)

Judgements by native informants of the place of tonic accent in TypeB words

Informants	S1	S2	S3	S4	S5	S6	S7	S8
TEMPORARY	C	C	C	C	C	C	C	C
CATEGORY	C	C	C	C	C	C	C	X
PRESENT (v)	C	C	C	C	C	X	C	C
COUNTENANCED	C	C	C	C	C	C	C	C
ADEQUATE	C	C	C	C	X	C	X	X
RELENTLESSLY	C	C	C	C	C	X	C	X
PELICAN	C	C	C	C	C	C	C	X
A [\] DULT	C	C	C	C	C	C	C	C
DIMINISH	C	C	C	C	C	X	C	X
TESTIMONY	C	C	C	C	C	X	C	X
IN [\] CENSE	C	C	C	C	C	C	C	C
EVIDENT	C	C	C	C	C	X	C	X
SUBSTANTIAL	C	C	C	C	C	C	C	C
ESTIMATE	C	C	C	C	C	X	C	C
SICILY	C	C	C	C	X	C	C	C
[\] NECESSARY	C	C	C	C	C	X	C	C
SILICA	C	C	C	C	X	X	C	C
PRESTON	C	C	C	C	C	C	C	C
PRESTWICK	C	C	C	C	C	C	C	C
ACCOUNT	C	C	C	C	C	C	C	C
SENTIMENT	C	C	C	C	C	C	C	X

(C correct judgement, X incorrect judgement)

Judgements by non-native informants of the place of tonic accent inType B words

Informants	S9	S10	S11	S12	S13	S14	S15	S16
TEMPORARY	C	X	C	C	C	C	X	C
CATEGORY	C	X	C	X	X	C	X	X
PRESENT (v)	X	C	C	X	C	C	C	X
COUNTENANCED	C	C	X	X	X	C	X	X
ADEQUATE	C	X	X	X	X	X	C	X
RELENTLESSLY	C	X	C	X	C	C	X	C
PELICAN	C	C	C	C	X	C	C	X
A\`DULT	C	C	X	X	C	C	C	C
DIMINISH	C	X	C	X	X	X	X	C
TESTIMONY	C	C	C	X	C	C	C	C
TERRESTRIAL	C	C	C	X	C	C	C	X
IN\`CENSE	C	X	C	X	C	C	C	C
EVIDENT	C	C	C	X	X	C	C	X
SUBSTANTIAL	C	X	C	C	C	C	C	C
ESTIMATE	C	C	C	C	X	C	C	C
SICILY	C	X	C	X	X	C	X	C
\NECESSARY	C	X	X	X	X	C	X	X
SILICA	C	C	C	X	X	C	C	X
PRESTON	C	C	C	X	C	C	C	X
PRESTWICK	C	C	C	C	C	C	C	C
ACCOUNT	C	X	C	C	C	C	C	C
SENTIMENT	C	C	C	X	C	C	C	X

(C correct judgement, X incorrect judgement)

Judgements by native informants of Sub-test 3 material

Informants	S1	S2	S3	S4	S5	S6	S7	S8
\MENTALITY	C	C	C	C	C	X0	C	XN
\INTERDEPEND	C	C	C	C	X0	XN	X0	XN
AIR\PORT	C	C	C	C	C	C	C	C
CON\SULTATION	C	C	C	C	C	C	C	C
\PERSEVERE	C	C	C	C	C	C	X0	XN
COM\POST	C	C	C	C	C	X	C	X
\UNDERSTAND	C	C	C	C	X0	C	X0	C
CA\TASTROPHIC	C	C	C	C	XN	XN	XN	X0
\MATRIMONIAL	C	C	C	C	XN	C	C	C
\CAPSIZE	C	C	C	C	C	C	C	X
A\CCUSATION	C	C	C	C	C	C	C	C

(C correct judgement, X incorrect judgement, X0 incorrect judgement as a result of opting for the lexicographically accented syllable, XN incorrect judgement as a result of not opting for the lexicographically accented syllable)

Appendix P3ii

Judgements by non-native informants of Sub-test 3 material

Informants	S9	S10	S11	S12	S13	S14	S15	S16
\MENTALITY	C	C	XO	XO	C	C	C	XO
\INTERDEPEND	C	C	XN	XN	XN	C	XO	XO
AIR\PORT	C	XO	C	C	C	C	C	C
CON\SULTATION	C	XN	XO	XO	C	C	C	C
\PERSEVERE	C	C	C	XN	C	XO	XN	C
COM\POST	C	C	C	C	C	C	C	C
\UNDERSTAND	XO	C	C	XO	XN	XN	XO	C
CA\TASTROPHIC	C	C	XO	XO	C	XO	XN	C
\MATRIMONIAL	C	C	XN	XO	XN	XO	C	XN
\CAPSIZE	XO	C	C	XO	C	XO	C	C
A\CCUSATION	C	C	C	C	C	C	C	C

(C correct judgement, X incorrect judgement, XO incorrect judgement as a result of opting for the lexicographically accented syllable, XN incorrect judgement as a result of not opting for the lexicographically accented syllable)

Appendix P4i

Judgements by native informants of Sub-test 4 material

Informants	S1	S2	S3	S4	S5	S6	S7	S8
HARM\FUL	C	C	C	C	C	C	C	C
HARM\LESS	C	C	C	C	C	C	X	X
\COMPREHEND	C	C	C	C	XN	C	C	XN
\REPREHEND	C	C	C	C	C	C	C	XN
\IMPORTED	C	C	C	C	C	C	C	C
\DEPORTED	C	C	C	C	C	C	C	C

(C correct judgement, X incorrect judgement, XN incorrect judgement as a result of not opting for the lexicographically accented syllable)

Appendix P4ii

Judgement by Non-native Informants of Sub-test 4 material

Informants	S9	S10	S11	S12	S13	S14	S15	S16
HARM\FUL	C	C	C	X	C	C	C	C
HARM\LESS	C	C	C	C	C	X	X	C
\COMPREHEND	C	C	XN	C	XN	C	C	C
\REPREHEND	C	C	C	XN	XO	XO	C	C
\IMPORTED	C	XO	C	C	C	XO	C	C
\DEPORTED	C	C	XO	XN	XO	C	C	C

(C correct judgement, X incorrect judgement, XO incorrect judgement as a result of opting for the lexicographically accented syllable, XN incorrect judgement as a result of not opting for the lexicographically accented syllable)

Judgements by native informants of Sub-test 5 material

Informants	S1			S2			S3			S4		
	C	LC	U	C	LC	U	C	LC	U	C	LC	U
\ADULT	.C	.C		.C	.C		.C	.C		.C	.C	
\CONVERSELY	.C	.C		.C	.C		.C	.C		.C	.C	
GELA\TINE	.C	.C		.C	.C		.C	.C		.C	.C	
\HOGMANAY	.C	.C		.C	.C		.C	.C		.C	.C	
PREMA\TURE	.C	.C		.C	.C		.C	.C		.C	.C	
\COMPLIMENT	.C	.C		.C	.C		.C	.C		.C	.C	
BENE\FACTION	.C	.C		.C	.C		.C	.C		.C	.C	
\AMATEUR	.C	.C		.C	.C		.C	.C		.C	.C	
Informants	S5			S6			S7			S8		
	C	LC	U	C	LC	U	C	LC	U	C	LC	U
\ADULT	.C	.C		.C	.C		.C	.C		.C	.C	
\CONVERSELY	.X	.X		.C .X			.C	.C		.C	.X	
GELA\TINE	.C	.C			.X .X		.C	.C		.X	.X	
\HOGMANAY	.C	.C		.C	.X		.C	.C		.C	.X	
\PREMATURE	.X .C				.X .X		.C	.C		.C	.C	
\COMPLIMENT	.C	.C			.X .X		.C	.C		.X	.X	
BENE\FACTION	.C	.C		.X	.X		.C	.C			.X .X	
\AMATEUR		.C	.X		.C	.X		.X .C		.C	.X	

(C accented syllable in the more common variant, LC accented syllable in the less common variant, U unaccented syllable, .C judging it correctly as accented, .X judging it incorrectly as accented)

Appendix P5ii

Judgements by non-native informants of Sub-test 5 material

Informants	S9			S10			S11			S12		
	C	LC	U	C	LC	U	C	LC	U	C	LC	U
\ ADULT	.C	.C			.C .C		.X	.X		.X .C		
\ CONVERSELY	.C	.C			.X .C		.C	.C			.X .C	
GELA\TINE	.C	.C			.X .C		.C	.C			.C	.X
\ HOGMANAY	.C	.C			.C	.C		.X	.X	.C		.X
PREMA\TURE	.X .C					.X .X		.X .C		.C	.C	
\ COMPLIMENT	.C	.C			.X .C		.C		.X	.X .C		
BENE\FACTION	.X .C				.C	.C		.X .C		.X		.X
\ AMATEUR		.X .C			.X .C		.C	.C		.C		.X

(continued below)

Informants	S13			S14			S15			S16		
	C	LC	U	C	LC	U	C	LC	U	C	LC	U
\ ADULT		.X .C			.X .C		.C	.C			.X .C	
\ CONVERSELY		.X .C		.C	.C			.X .C		.X .C		
GELA\TINE	.C	.C		.X .C			.C	.C		.X .C		
\ HOGMANAY	.X .C			.X .C			.C	.C			.X	.X
PREMA\TURE		.C	.X	.X .C			.X .C			.C	.C	
\ COMPLIMENT		.X	.X	.X .C			.C	.X		.C		.X
BENE\FACTION	.C	.C		.C	.C		.X	.C		.C	.C	
\ AMATEUR		.X .C		.X .C			.C	.C		.C	.C	

(C accented syllable in the more common variant, LC accented syllable in the less common variant, U unaccented syllable, .C judging it correctly as accented, .X judging it incorrectly as accented)

Appendix P6i

Judgements by native informants of Sub-test 6 material

Informants	Syllable Weight	S1	S2	S3	S4	S5	S6	S7	S8
EVIDENT	V	C	C	C	C	C	X	C	X
ESTIMATE	V	C	C	C	C	C	X	C	C
TERRESTRIAL	CV	C	C	C	C	C	X	C	X
TESTIMONY	CV	C	C	C	C	C	X	C	X
PELICAN	CV	C	C	C	C	C	C	C	X
\NECESSARY	CV	C	C	C	C	C	X	C	C
PRESTON	CCV	C	C	C	C	C	C	C	C
TEMPORARY	CVC	C	C	C	C	C	C	C	C
EVIDENTIAL	CVC	C	C	C	C	C	C	C	X
PRESENT	CVCC	C	C	C	C	C	X	C	C
IN\CENSE	CVCC	C	C	C	C	C	C	C	C
RELENTLESSLY	CVCC	C	C	C	C	C	X	C	X
PRESTWICK	CCVCC	C	C	C	C	C	C	C	C

(C correct judgement, X incorrect judgement)

Judgements by non-native informants of Sub-test 6 material

Informants	Syllable Weight	S9	S10	S11	S12	S13	S14	S15	S16
EVIDENT	V	C	C	C	X	X	C	C	X
ESTIMATE	V	C	C	C	C	X	C	C	C
TERRESTRIAL	CV	C	C	C	X	C	C	C	C
TESTIMONY	CV	C	C	C	X	C	C	C	C
PELICAN	CV	C	C	C	C	X	C	C	X
\ NECESSARY	CV	C	X	X	X	X	C	X	X
PRESTON	CCV	C	C	C	X	C	C	C	X
TEMPORARY	CVC	C	X	C	C	C	C	X	C
EVIDENTIAL	CVC	C	C	C	X	C	X	X	X
PRESENT	CVCC	C	C	C	C	C	X	C	C
IN\ CENSE	CVCC	C	C	C	C	C	C	C	X
RELENTLESSLY	CVCC	C	X	C	X	C	C	X	C
PRESTWICK	CCVCC	C	C	C	C	C	C	C	C

(C correct judgement, X incorrect judgement)

Judgements by native informants of Sub-test 7 material

Informants	S1	S2	S3	S4	S5	S6	S7	S8
SUBSTANTIATION after SUBSTANTIAL	C	C	C	C	XN	XO	XO	XO
NECESSITATE after NECESSARY	C	C	C	C	C	C	C	XN
EVIDENTIAL after EVIDENT	C	C	C	C	C	C	C	XN
MULTIPLICITY after MULTIPLY	C	C	C	C	C	XN	C	C
SIGNIFICANCE after SIGNIFY	C	C	C	C	XO	XO	XO	C
SENTIMENTALLY after SENTIMENT	C	C	C	C	C	XN	C	C

(C correct judgement, XO incorrect judgement as a result of opting for the accented syllable in a root-related word, XN incorrect judgement with no opting for the accented syllable in a root-related word)

Judgements by non-native informants of Sub-test 7 material

Informants	S9	S10	S11	S12	S13	S14	S15	S16
SUBSTANTIATION after SUBSTANTIAL	XN	C	XN	C	XO	XO	XN	XO
NECESSITATE after NECESSARY	XN	XN	XN	XN	C	C	C	XN
EVIDENTIAL after EVIDENT	C	C	C	XN	C	XN	XO	XN
MULTIPLICITY after MULTIPLY	C	XN	C	XN	C	XO	XN	C
SIGNIFICANCE after SIGNIFY	XO	XO	XO	XO	XN	XN	XN	XO
SENTIMENTALLY after SENTIMENT	C	C	XN	XN	C	C	XN	XN

(C correct judgement, XO incorrect judgement as a result of opting for the accented syllable in a root-related word, XN incorrect judgement with no opting for the accented syllable in a root-related word)

Judgements by native informants of Sub-test 8 material

Informants	S1	S2	S3	S4	S5	S6	S7	S8
STOP-WATCH	C	C	C	C	C	C	C	C
COCA-COLA	C	C	C	C	C	XNE	C	XNE
LETTER-BALANCE	C	C	C	C	C	XNE	C	C
GOAL-POST	C	C	C	C	C	C	C	C
EASTER-DAY	C	C	C	C	C	XNE	C	C
TAXI-CAB	C	C	C	C	C	C	C	C
MOUTH-ORGAN	C	C	C	C	C	C	C	XNE
RUNNER-UP	C	C	C	C	C	XNE	C	C
MEALTIME	C	C	C	C	C	C	C	C

(C correct judgement, XNE incorrect judgement as a result of opting for neither of the two prominent syllables in the word)

Judgements by non-native informants of Sub-test 8 material

Informants	S9	S10	S11	S12	S13	S14	S15	S16
STOP-WATCH	C	X	C	C	C	X	C	C
COCA-COLA	C	C	C	C	C	C	C	XO
LETTER-BALANCE	C	XO	XNE	XO	XNE	XO	XO	XO
GOAL-POST	C	X	X	C	X	X	C	C
EASTER-DAY	XO	XO	C	XNE	XO	C	C	C
TAXI-CAB	C	C	XNE	XO	C	C	C	C
MOUTH-ORGAN	XNE	XO	C	XO	C	C	XO	C
RUNNER-UP	XNE	XO	C	XO	C	C	XO	C
MEALTIME	C	C	X	X	C	C	C	C

(C correct judgement, X incorrect judgement, XO incorrect judgement as a result of opting for another prominent syllable in the word, XNE incorrect judgement as a result of opting for neither of the two prominent syllables in the word)

Appendix Qi

An example of alternative statistical calculations

(Based on Table Di , page 93)

Statistical calculations	S1	S2	S3	S4
Arithmetic mean	79.88	96.25	66.00	69.50
Standard deviation	20.77	37.14	12.30	14.97
Standard score	0.15	1.3	0.9	0.6

Appendix Qii

An example of alternative statistical calculations

(Based on Table DU, page 123)

Statistical calculations	S1		S2		S3		S4	
	*	X	*	X	*	X	*	X
Arithmetic mean	51.6	54.90	73.6	54.4	67.14	34.86	66.0	57.22
Standard deviation	12.14	15.14	29.66	35.16	20.62	12.13	25.27	41.72
Standard score	1.4	0.44	0.97	0.39	0.27	1.48	0.15	0.67

* Cases of comparison involving two syllables both with primary tonic accent.

X Cases of comparison involving two syllables one of which receives a primary non-tonic accent.

Where marked *, a reference is missing. Missing references are inserted in alphabetical order on page 442.

ABERCROMBIE, D. (1964a). Syllable quantity and enclitics in English. In Studies in Phonetics and Linguistics, 26-34. London: Oxford University Press.

ABERCROMBIE, D. (1964b). A phonetician's view of verse structure. In Studies in Phonetics and Linguistics, 16-25. London: Oxford University Press.

ABERCROMBIE, D. (1967). Elements of General Phonetics. Edinburgh: Edinburgh University Press.

ADAMS, C. and MUNRO, R. R. (1978). In search of the acoustic correlates of stress: fundamental frequency, amplitude and duration in the connected utterance of some native and non-native speakers of English. Phonetica, 35, 1978, 124-156.

AITCHISON, J. (1987). Words in the Mind: An Introduction to the Mental Lexicon. Oxford: Basil Blackwell.

ARNOLD, G. F. (1956/1957). Stress in English words. Lingua, 6, 1956/1957: 221-267 and 397-441.

ATKINSON, J. E. (1973). Aspects of Intonation in Speech: Implications from an Experimental Study of Fo. Doctoral dissertation, University of Connecticut.

ATKINSON, J. E. (1978). Correlation analysis of the physiological factors controlling fundamental voice frequency. Journal of the Acoustical Society of America, 63, 1, 1978, 211-222.

BANNERT, R. (1987). On the role of accent syllables in speech perception. Reports from Uppsala University Department of Linguistics, 17, 1987, 65-71.

BARRY, W. J. (1981). Prosodic functions revisited again. Phonetica, 38, 1981, 320-340.

BECKMAN, M. E. (1982). Effects of accent on vowel duration in Japanese. Journal of the Acoustical Society of America, 71, 1982, Supplement, S23.

BECKMAN, M. E. (1984). Effects of accent on vowel amplitude in Japanese. Journal of the Acoustical Society of America, 75, 1984, Supplement, S41.

BECKMAN, M. E. (1985). Perceptual cues to lexical accent contrasts in English and Japanese. Journal of the Acoustical Society of America, 78, 1985, Supplement, S20-S21.

BECKMAN, M. E. (1986). Stress and Non-Stress Accent. Dordrecht: Foris Publications.

- BELL, A. (1977). Accent placement and perception of prominence in rhythmic structures. In Hyman L.M. (ed.) Studies in Stress and Accent, 1-13. Los Angeles: Southern California Occasional Papers in Linguistics, 4.
- BENGUEREL, A. and D'ARCY, J. (1986). Time warping and the perception of rhythm in speech. Journal of Phonetics, 14, 1986, 231-246.
- BERGER, M. D. (1955). Vowel distribution and accentual prominence in English. Word, 11, 1955: 361-376.
- BERINSTEIN, A. E. (1979). A cross-linguistic study on the perception and production of stress. UCLA Working Papers in Phonetics, 47, 1979.
- BERKOVITS, R. (1984). Duration and fundamental frequency in sentence-final intonation. Journal of Phonetics, 12, 3, 1984, 255-265.
- BERTINETTO, P. M. (1980). The perception of stress by Italian speakers. Journal of Phonetics, 8, 1980, 385-395.
- BING, J. M. (1979). Aspects of English Prosody. Bloomington: Linguistics Club, Indiana University.
- ★
- BLOOMFIELD, L. (1933). Language. London: George Allen and Unwin.
- BOE, L. and RAKOTOFIRINGA, H. (1975). A statistical analysis of laryngeal frequency: its relationship to intensity level and duration. Language and Speech, 18, 1978, 1-13.
- BOLINGER, D. L. (1958a). A theory of pitch accent in English. In Abe, I. and Kanekiyo, T. (eds.). Forms of English: Accent, Morpheme, Order, 17-55. Cambridge, Massachusetts: Harvard University Press, 1965.
- BOLINGER, D. L. (1958b). Intensity as a qualitative improvement of pitch accent. Lingua, 7, 1958, 175-182.
- BOLINGER, D. L. (1958c). Stress and information. In Abe, I. and Kanekiyo, T. (eds.). Forms of English: Accent, Morpheme, Order, 67-83. Cambridge, Massachusetts: Harvard University Press, 1965.
- BOLINGER, D. L. (1961). Contrastive accent and contrastive stress. In Abe, I. and Kanekiyo, T. (eds.). Forms of English: Accent, Morpheme, Order, 101-117. Cambridge, Massachusetts: Harvard University Press, 1965.
- BOLINGER, D. L. (1965a). Forms of English: Accent, Morpheme, Order. Abe, I. and Kanekiyo, T. (eds.) Cambridge, Massachusetts: Harvard University Press, 1965.
- BOLINGER, D. L. (1965b). Pitch accent and sentence rhythm. In Abe, I. and Kanekiyo, T. (eds.). Forms of English: Accent, Morpheme, Order, 139-180. Cambridge, Massachusetts: Harvard University Press, 1965.

BOLINGER, D. L. (1986). Intonation and Its Parts: Melody in Spoken English. Stanford: Stanford University Press.

BROWMAN, C. D. (1978). Tip of the Tongue and Slip of the Ear: Implications for Language Processing. Ph.D. dissertation, University of California.

BROWN, G., CURRIE, K., and KENWORTHY, J. (1980). Questions of Intonation. London: Croom Helm.

BUXTON, H. (1983). Temporal predictability in the perception of English speech. In Cutler, A. and Ladd, D. R. (eds.). Prosody: Models and Measurements, 111-121. Berlin: Springer-Verlag.

CATFORD, J. C. (1977). Fundamental Problems in Phonetics. Edinburgh: Edinburgh University Press.

CHOMSKY, N. and HALLE, M. (1968). The Sound Pattern of English. New York, Evanston, London: Harper & Row.

CHRISTOPHERSEN, P. (1956). An English Phonetics Course. London: Longman.

COHEN, A. (1980). The word as a processing unit in speech perception. In Alkemade, D.V., Feitsma, A., Meys, W.J., Reenen, R.V. and Spa, J.J. (eds.). Linguistic Studies Offered to Berthe Siertsema, 257-267. Amsterdam: Costerus Ser.

COLLIER, R. (1974). Laryngeal muscle activity, subglottal air pressure, and the control of pitch in speech. Haskins Laboratories Status Report on Speech Research, SR-39/40, 1974, 137-170.

COLLIER, R. (1975). Physiological correlates of intonation patterns. Journal of the Acoustical Society of America, 58, 1, 1975, 249-255.

COOPER, A.M. and FOWLER, C.A. (1984). Stress centres are not perceived categorically. Journal of the Acoustical Society of America, 76, 1984, Supplement, S89-90.

COOPER, W. E., BLUMSTEIN, S. E., and NIGRO, G. (1975). Articulatory effects on speech perception: a preliminary report. Journal of Phonetics, 3, 1975: 87-98.

COOPER, W. E., BILLING, D., and COLE, R. A. (1976). Articulatory effects on speech perception: a second report. Journal of Phonetics, 4, 1976: 219-232.

COUPER-KUHLEN, E. (1986). An Introduction to English Prosody. Tübingen: Max Niemeyer Verlag.

CRUTTENDEN, A. (1986). Intonation. London: Cambridge University Press.

CURRIE, K. L. (1981). Further experiments in the search of tonics. Language and Speech, 24, 1, 1981, 1-28.

CUTLER, A. (1983a). Speakers' conceptions of the function of prosody. In Cutler, A. and Ladd, D. R. (eds.). Prosody: Models and Measurements, 79-92. Berlin: Springer-Verlag.

CUTLER, A. (1983b). Semantics, syntax and sentence accent. In Cohen, A. and Broeke M-P.R. v.d. (eds.) Abstracts of the Tenth International Congress of Phonetic Sciences, 1983, 85-91. Dordrecht: Foris Publications.

CUTLER, A. (1984). Stress and accent in language production and understanding. In Gibbon, D. and Richter, H. (eds.). Intonation, Accent and Rhythm, 77-90. Berlin, New York: Walter de Gruyter.

CUTLER, A. and CLIFTON, C. E. (1983). Lexical stress effects on phonetic categorization in auditory word perception. In Cohen, A. and Broeke, M-P.R. v.d. (eds.). Abstracts of the Tenth International Congress of Phonetic Sciences, 531. Dordrecht: Foris Publications.

CUTLER, A. and DARWIN, C. J. (1981). Phoneme-monitoring reaction time and preceding prosody: effects of stop closure duration and of fundamental frequency. Perception and Psychophysics, 29, 3, 1981, 217-224.

CUTLER, A. and FOSS, J. (1977). On the role of sentence stress in sentence processing. Language and Speech, 20, 1977, 1-10.

CUTLER, A. and ISARD, S. P. (1980). The production of prosody. In Butterworth, B. (ed.). Language Production, 245-269. London: Academic Press.

CUTLER, A. and LADD, D. R. (eds.) (1983). Prosody: Models and Measurements. Berlin: Springer-Verlag.

DARWIN, C. J. (1975). On the dynamic use of prosody in speech perception. Haskins Laboratories Status Report on Speech Research, SR-42/43, 1975, 103-114.

DARWIN, C. J. and DONOVAN, A. (1980). Perceptual studies of speech rhythm: isochrony and intonation. In Simon, J. C. (ed.). Spoken Language Generation and Understanding, 77-85. Dordrecht: Reidel Publishing Company.

DAUER, R. M. (1983). Stress-timing and syllable-timing reanalyzed. Journal of Phonetics, 11, 1983, 51-62.

DELATTRE, P. (1964). Change as a correlate of the vowel-consonant distinction. Studia Linguistica, 18, 1964, 12-25.

FONAGY, I. (1966). Electrophysiological and acoustic correlates of stress and stress perception. Journal of Speech and Hearing Research, 9, 1966, 231-244.

★
FOWLER, C. A. (1977). Timing Control in Speech Production.
Bloomington: Indiana University Linguistics Club.

FROMKIN, V. A. (1977). Putting the emPHAsis on the wrong syllABLE. In Hyman, L. M. (ed.). Studies in Stress and Accent, 15-26. Los Angeles: Southern California Occasional Papers in Linguistics.

FRY, D. B. (1955). Duration and intensity as physical correlates of linguistic stress. Journal of the Acoustical Society of America, 27, 4, 1955, 765-768.

FRY, D. B. (1958). Experiments on the perception of stress. Language and Speech, 1, 1958, 126-151.

FRY, D. B. (1965). The dependence of stress judgements on vowel formant structure. Progress Report, Phonetics Laboratory, University College London, 1965, 64-74.

FRY, D. B. (1979). The Physics of Speech. Cambridge: Cambridge University Press.

FUDGE, E. (1984). English Word Stress. London: George Allen and Unwin.

GAITENBY, J. H. (1975). Stress and the elastic syllable: an acoustic method for delineating lexical stress patterns in connected speech. Haskins Laboratories Status Report on Speech Research, SR-41, 1975, 137-152.

GANDOUR, J., WEINBERG, B., and KOSOWSKY, A. (1982). Perception of syntactic stress in alaryngeal speech. Language and Speech, 25, 1982, 299-304.

★

GAY, T. (1978). Physiological and acoustic correlates of perceived stress. Language and Speech, 21, 4, 1978, 347-353.

GELFER, C. F., HARRIS, K. S., and BAER, T. (1987). Controlled variables in sentence intonation. Haskins Laboratories Status Report on Speech Research, SR-89/90, 1987, 57-69.

GIMSON, A. C. (1956). The linguistic relevance of stress in English. Zeitschrift für Phonetik, 9, 1956, 143-149.

GIMSON, A. C. (1980). An Introduction to the Pronunciation of English, 3rd edition. London: Edward Arnold.

GOLDSTEIN, L.M. (1977). Perceptual salience of stressed syllables. In Three Studies in Speech Perception: Features, Relative Salience and Bias, 38-59. Ph.D. thesis, University of Claifornia.

GUIERRE, L. (1967). Accent secondaire et segmentation en anglais. Les Langues Modernes, 61, 1967, 343-352.

GUIERRE, L. (1970). Drills in English Stress-Patterns. London: Longman.

GUIERRE, L. (1978). L'accentuation en anglais contemporain. Ph.D. thesis, Université Paris.

HARRIS, K. S. (1970). Physiological aspects of articulatory behavior. Haskins Laboratories Status Report on Speech Research, SR-23, 1970, 49-68.

HARRIS, K. S. (1971). Vowel stress and articulatory reorganization. Haskins Laboratories Status Report on Speech Research, SR-28, 1971, 167-178.

HARRIS, K. S. (1973). Stress and syllable duration change. Haskins Laboratories Status Report on Speech Research, SR-35/36, 1973, 31-38.

HARRIS, K. S. (1978). Vowel duration change and its underlying physiological mechanisms. Language and Speech, 21, 4, 1978, 354-361.

HARRIS, K. S., GAY, T., and LIEBERMAN, P. (1968). Some stress effects on electromyographic measures of consonant articulations. Haskins Laboratories Status Report on Speech Research, SR-13/14, 1968, 137-152.

HARRIS, K. S., GAY, T., LIEBERMAN, P., and SHOLES, G. (1969). The function of the muscles in control of stress and intonation. Haskins Laboratories Status Report on Speech Research, SR-19/20, 127-138.

HEFFNER, R. M. S. (1950). General Phonetics. Madison: The University of Wisconsin Press.

HENDERSON, E. J. A. (ed.) (1971). The Indispensable Foundation: A Selection from the Writings of Henry Sweet. London: Oxford University Press.

HEWSON, J. (1980). Stress in English: four levels or three? The Canadian Journal of Linguistics, 25,2, 1980, 197-203.

HUSS, V. (1978). English word stress in the post-nuclear position. Phonetica, 35, 2, 1978, 86-105.

ISENBERG, D. and GAY, T., (1978). Acoustic correlates of perceived stress in an isolated synthetic disyllable. Journal of the Acoustical Society of America, 64, 1978, Supplement, S21.

JANOTA, P. and PALKOVA, Z. (1974). The auditory evaluation of stress under the influence of context. Phonetica Pragensia, 4, 1974, 29-59.

JASSEM, W. (1949). Indication of speech rhythm in the transcription of educated southern English. Le Maître Phonétique, 92, 1949, 22-24.

JASSEM, W. (1952a). The Intonation of Conversational English. Wrocław: Travaux de la Société des Sciences et des Lettres.

JASSEM, W. (1952b). Stress in modern English. Bulletin de la Société Polonaise de Linguistique, 11, 1952, 21-49.

JASSEM, W. and GIBBON, D. (1980). Redefining English accent and stress. Journal of the International Phonetic Association, 10, 1980, 2-16.

JESPERSEN, O. (1922). Language, Its Nature, Development and Origin. London: George Allen and Unwin.

JESPERSEN, O. (1933) Lehrbuch der Phonetik, 5th edition. Leipzig, Berlin: B.G. Teuber.

JONES, D. (1931). The word as a phonetic entity. In Jones, W.E. and Laver, J. (eds.). Phonetics in Linguistics: A Book of Readings, 154-158, London: Longman, 1973.

JONES, D. (1960). An Outline of English Phonetics, 9th edition. Cambridge: W. Heffer & Sons Ltd.

JONES, D. (1967/1977). English Pronouncing Dictionary, 13th and 14th editions. London: Dent.

KATWIJK, A. (1971). Subglottal pressure and linguistic stress. IPO Annual Progress Report, 6, 1971, 31-34.

KATWIJK, A. (1972). On the perception of stress. Phonetica Pragensia, 3, 1972, 127-135.

KATWIJK, A. and GOVAERT, G. (1967). Prominence as a function of the location of pitch movement. IPO Annual Progress Report, 2, 1967, 115-117.

KENT, R. D. and NETSELL, R. (1971). Effects of stress contrasts on certain articulatory parameters. Phonetica, 24, 1971, 23-44.

KINGDON, R. (1958). The Groundwork of English Stress. London: Longman.

KLATT, D. H. and COOPER, W. E. (1975). Perception of vowel duration in sentence context. Journal of the Acoustical Society of America, 57, 1957, Supplement, S47-S48.

KNOWLES, G. (1974). The rhythm of English syllables. Lingua, 34, 1974, 115-147.

KOZHEVNIKOV, V. A. and CHISTOVICH, L. A. (1965). Speech: Articulation and Perception. Washington D. C.: Joint Publications Research Service, U.S. Department of Commerce.

KRAMSKY, J. (1969). The Word as a Linguistic Unit. The Hague, Paris: Mouton.

KRUISINGA, E. (1943). The Phonetic Structure of English Words. Bern: A. Francke AG.

LACKNER, J. R. and TULLER, B. (1976). The influence of syntactic segmentation on perceived stress. Cognition, 4, 1976, 303-307.

LADD, D. R. and CUTLER, A. (1983). Introduction: models and measurements in the study of prosody. In Cutler, A. and Ladd, D. R. (eds.). Prosody: Models and Measurements, 1-10. Berlin: Springer-Verlag.

LADEFOGED, P. (1967a). Stress and respiratory activity. In Three Areas of Experimental Phonetics, 1-49. London: Oxford University Press.

LADEFOGED, P. (1967b). The nature of vowel quality. In Three Areas of Experimental Phonetics, 50-142. London: Oxford University Press.

LADEFOGED, P. (1967c). Units in the perception and production of speech. Three Areas of Experimental Phonetics, 143-172. London: Oxford University Press.

LADEFOGED, P. and BROADBENT, D. E. (1957). Information conveyed by vowels. Journal of the Acoustical Society of America, 21, 1, 1957, 98-104.

LADEFOGED, P. (1982). A Course in Phonetics, 2nd edition. New York: Harcourt Brace Jovanovich.

LEA, W. A. (1973). Segmental and suprasegmental influences on fundamental frequency contours. In Hyman, L. M. (ed.). Consonant Types and Tone, 15-70. Los Angeles: Southern California Occasional Papers in Linguistics, 1, 1973.

LEA, W. A. (1977). Acoustic correlates of stress and juncture. In Hyman, L. M. (ed.). Studies in Stress and Accent, 83-119. Los Angeles: Southern California Occasional Papers in Linguistics, 4, 1977.

LEHISTE, I. (1975). The role of the temporal factors in the establishment of linguistic units and boundaries. In Dressler, W. U. and Mares, F. V. (eds.). Phonologica 1972: Akten der Zweiten Phonologie-Tagung, 115-122. München, Salzburg: Wilhelm Fink Verlag.

LEHISTE, I. (1976). Suprasegmental features of speech. In Lass, N. J. (ed.) Contemporary Issues in Experimental Phonetics, 225-239. New York: Academic Press.

LEHISTE, I. (1977). Isochrony reconsidered. Journal of Phonetics, 5, 1977, 253-263.

LEHISTE, I. (1980). Phonetic manifestation of syntactic structure in English. Annual Bulletin of the Research Institute of Logopedics and Phoniatrics, 14, 1980, 1-27.

LEHISTE, I. (1984). The many linguistic functions of duration. In Copeland, J. E. (ed.). New Directions in Linguistics and Semiotics, 96-122. Amsterdam: John Benjamins.

LIBERMAN, A. M. (1957). Some results of research on speech perception. Journal of the Acoustical Society of America, 29, 1, 1957, 117-123.

LIEBERMAN, P. (1960). Some acoustic correlates of word stress in American English. Journal of the Acoustical Society of America, 32, 4, 1960, 451-457.

LIEBERMAN, P. (1968). On the structure of prosody. Zeitschrift für Phonetik, 21, 1968, 157-163.

LIEBERMAN, P. (1970). A study of prosodic features. Haskins Laboratories Status Report on Speech Research, SR-23, 1970, 179-208.

LIEBERMAN, P. (1977). Speech Physiology and Acoustic Phonetics. New York: Macmillan.

LIEBERMAN, P., SWASHIMA, M., HARRIS, K., and GAY, T. (1970). The articulatory implementation of the breath-group and prominence: cricothyroid muscular activity in intonation. Language, 46, 2, 1970, 312-327.

LIEBERMAN, P., KNUDSON, R., and MEAD, J. (1969). Determination of the rate of change of fundamental frequency with respect to subglottal pressure during sustained phonation. Journal of the Acoustical Society of America, 45, 1969, 1537-1543.

LIGHTFOOT, M. J. (1970). Accent and time in descriptive prosody. Word, 26, 1, 1970, 47-64.

LINDBLOM, B. (1963). Spectrographic study of vowel reduction. Journal of the Acoustical Society of America, 35, 2, 1963, 1773-1781.

LINDSTROM, O. (1978). Aspects of English Intonation. Göteborg: Acta Universitatis Gothoburgensis.

MARTINET, A. (1952). Function, structure, and sound change. Word, 8, 1952, 1-32.

MCCLEAN, M. D. and TIFFANY, W. R. (1973). The acoustic parameters of stress in relation to syllable-position, speech loudness and rate. Language and Speech, 16, 1973, 283-291.

MCNEILL, D. and REPP, B. (1973). Internal processes in speech perception. Journal of the Acoustical Society of America, 53, 5, 1973, 1320-1326.

MOL, H. and UHLENBECK, E. M. (1955). The linguistic relevance of intensity in stress. Lingua, 5, 1955, 205-213.

MORTON, J. and JASSEM, W. (1965). Acoustic correlates of stress. Language and Speech, 8, 2, 1965, 159-181.

MURRAY, J.A.H. (ed.). (1933). Oxford English Dictionary. Oxford: Clarendon Press.

MUYSKENS, J. M. (1931). An analysis of accent in English from kymographic records. Vox, 17, 1931, 55-65.

NAKATANI, L. H., O'CONNOR, K. D., and ASTON, C. H. (1981). Prosodic aspects of American speech rhythm. Phonetica, 38, 1-3, 1981, 84-105.

NAKATANI, L. H. and SCHAFFER, J. A. (1978). Hearing "words" without words: prosodic cues for word perception. Journal of the Acoustical Society of America, 63, 1, 1978, 234-245.

NEARY, T. M. (1980). On the physical interpretation of vowel quality: cinefluorographic and acoustic evidence. Journal of Phonetics, 8, 1980, 213-241.

NETSELL, R. (1969). A Perceptual - Acoustic - Physiological Study of Syllable Stress. Ph.D. thesis, Graduate College, University of Iowa.

NEWMAN, S. S. (1946). On the stress system of English. Word, 2, 1946, 171-187.

NOOTBOOM, S. G. (1972). Production and Perception of Vowel Duration: A Study of Duration Properties of Vowels in Dutch. Doctoral dissertation, University of Utrecht.

O'CONNOR, J. D. (1965). The perception of time intervals. Progress Report, Phonetics Laboratory, University College London, 1965, 11-12.

O'CONNOR, J. D. (1968). The duration of the foot in relation to the number of component sound segments. Progress Report, Phonetics Laboratory, University College London, 1968, 1-3.

O'CONNOR, J. D. (1973). Phonetics. Harmondsworth: Penguin Books.

O'CONNOR, J. D. and ARNOLD, G. F. (1973). Intonation of Colloquial English, 2nd edition. London: Longman.

O'CONNOR, J. D. and TRIM, J. L. M. (1953). Vowel, consonant, and syllable - a phonological definition. Word, 9, 2, 1953, 103-122.

OHALA, J. (1977). The physiology of stress. In Hyman, L. M. (ed.). Studies in Stress and Accent, 145-168. Los Angeles: Southern California Occasional Papers in Linguistics, 4, 1977.

OHALA, J. (1978). The production of tone. In Fromkin, V. (ed.). Tone: A Linguistic Survey, 5-39. London: Academic Press.

OHALA, J. and HIRANO, M. (1967). Studies of pitch change in speech. UCLA Working Papers in Phonetics, 7, 1967, 80-84.

OHALA, J. and LADEGOGED, P. (1969). Further investigation of pitch regulation in speech. UCLA Working Papers in Phonetics, 14, 1969, 12-24.

PARMENTER, C. E. and TREVINO, S. N. (1935). The length of the sounds of a Middle Westerner. American Speech, 10, 1935, 129-133.

★

PETERSON, G. E. and LEHISTE, I. (1960). Duration of syllable nuclei in English. Journal of the Acoustical Society of America 32, 6, 1960, 693-703.

PIKE, K. (1945). Intonation of American English. Ann Arbor: University of Michigan Press.

PIERREHUMBERT, J. (1979). The perception of fundamental frequency declination. Journal of the Acoustical Society of America, 66, 2, 1979, 363-369.

POLDAUF, I. (1984). English Word Stress. Oxford: Pergamon Press.

PRICE, P. J. (1980). Sonority and syllabicity: acoustic correlates of perception. Phonetica, 37, 1980, 327-343.

RAKARD, B., VERBRUGG, R. R., and SHANKWEILER, D. P. (1980). Speaking rate, syllable stress and vowel identity. Haskins Laboratories Status Report on Speech Research, SR-62, 1980, 149-159.

ROSENVOLD, E. (1981). The role of intrinsic Fo and duration in the perception of stress. Annual Report of the Institute of Phonetics, University of Copenhagen, 15, 1981, 147-166.

SCHMERLING, S. F. (1976). Aspects of English Sentence Stress. Texas: University of Texas Press.

SCOTT, N. C. (1939). An experiment on stress perception. Le Maître Phonétique, 67, 1937, 44-45.

SHARP, A. E. (1960). The analysis of stress and juncture in English. Transactions of the Philological Society, 1960, 104-135.

SHAYNE, J. and GASS, S. (1976). An investigation of the role of stress as a factor in speech perception. UCLA Working Papers in Phonetics, 31, 1976, 78-85.

SIEVERS, E. (1901). Grundzüge der Phonetik, 5th edition. Leipzig: Breitkopf & Härtel.

SILVERMAN, K. (1984). Fo perturbations as a function of voicing of prevocalic and postvocalic fricatives, and of syllable stress. Proceedings of the Institute of Acoustics, 6, 4, 1984, 445-452.

SIMPSON, J.M.Y. (1979). A First Course in Linguistics. Edinburgh: Edinburgh University Press.

STEELE, S. A. (1985). Vowel Intrinsic Fundamental Frequency in Prosodic Context. Doctoral dissertation, University of Texas.

STEELE, S. A. (1986). Interaction of Fo and prosody. Phonetica, 43, 1986, 92-105.

STETSON, R. H. (1951). Motor Phonetics, 2nd edition. Amsterdam: North-Holland Publishing Company.

STEVENS, K. N. (1968). On the relation between speech movements and speech perception. Zeitschrift für Phonetik, 21, 1968, 102-106.

STEVENS, K. N. and HALLE, M. (1967). Remarks on analysis by synthesis and distinctive features. In Wathen-Dunn, W. (ed.). Models for the Perception of Speech and Visual Form, 88-102. Cambridge, Massachusetts, London: The M.I.T. Press.

STUDDERT-KENNEDY, M., LIBERMAN, A. M., HARRIS, K. S. and FRANKLIN, S. (1969). The motor theory of speech perception: A reply to Lane's critical review. Haskins Laboratories Status Report on Speech Research, SR-19/20, 1969, 139-188.

SUSSMAN, H. M. and MacNEILAGE, P. F. (1978). Motor unit correlates of stress: preliminary observations. Journal of the Acoustical Society of America, 64, 1, 1978, 338-340.

SWASHIMA, M., GAY, T., and HARRIS, K. S. (1969). Laryngeal muscle activity during vocal pitch and intensity changes. Haskins Laboratories Status Report on Speech Research, SR-19/20, 1969, 211-200.

SWASHIMA, M. and HIROSE, H. (1983). Laryngeal gestures in speech production. In MacNeilage, P. F. (ed.). The Production of Speech, 11-38. New York, Heidelberg, Berlin: Springer-Verlag.

TAYLOR, S. and WALES, R. (1987). Primitive mechanisms of accent perception. Journal of Phonetics, 15, 1987, 235-246.

TERKEN, J. M. B. (1983). The effect of accentuation on comprehension: an experiment. In Cohen, A. and Broeke, M-P. R. v.d. (eds.). Abstracts of the 10th International Congress of Phonetic Sciences, 590. Dordrecht: Foris Publications.

THOMPSON, H. (1980). Stress and Salience in English: Theory and Practice. Doctoral dissertation, University of California.

Thorsen, N. (1982). On the variability in Fo patterning and the function of Fo timing in languages where pitch cues stress. Phonetica, 39, 1982, 302-316.

TULLER, B. and FOWLER, A. (1980). Some articulatory correlates of perceptual isochrony. Haskins Laboratories Status Report on Speech Research, SR-62, 1980, 87-100.

TULLER, B., HARRIS, K. S. and SCOTT KELSO, J. A. (1981a). Articulatory motor events as a function of speaking rate and stress. Haskins Laboratories Status Report on Speech Research SR-65, 1981, 33-62.

TULLER, B., SCOTT KELSO, J. A. and HARRIS, K. S. (1981b). Phase relationships among articulator muscles as a function of speaking rate and stress. Haskins Laboratories Status Report on Speech Research, SR-65, 1981, 63-90.

TULLER, B., SCOTT KELSO, J. A. and HARRIS, K. S. (1982a). Stress and rate: differential transformations of articulation. Journal of the Acoustical Society of America, 71, 6, 1982, 1534-1543.

TULLER, B., SCOTT KELSO, J. A. and HARRIS, K. S. (1982b). On the kinematics of articulatory control as a function of stress and rate. Haskins Laboratories Status Report on Speech Research, SR-71/72, 1982, 81-88.

UMEDA, N. (1975). Vowel duration in American English. Journal of the Acoustical Society of America, 58, 2, 1975, 434-445.

VAISSIERE, J. (1983). Language-independent prosodic features. In Cutler, A. and Ladd, D. R. (eds.). Prosody: Models and Measurements, 53-66. Berlin: Springer-Verlag.

VANVIK, A. (1961). On Stress in Present-Day English: Received Pronunciation. Oslo: Norwegian Universities Press.

WANG, C.-T. (1953). Applied Elasticity. London: McGraw-Hill.

WARD, I. C. (1945). The Phonetics of English, 4th edition. London: Heffer.

WELLS, J. C. (1982). Accents of English. Volume 2: The British Isles. London: Cambridge University Press.

WILLIAMS, B. (1986). An acoustic study of some features of Welsh prosody. In Johns-Lewis, C. (ed.). Intonation in Discourse, 35-51. San Diego: College Hill Press.

WILLIAMS, J. G. (1973). Stress Analysis of Polymers. London: Longman.

BLOOMFIELD, L. (1930) German ç and x. Le Maître Phonétique, 3, 1930:27-28.

FOSS, D. J. and SWINNEY, D. A. (1973) On the psychological reality of the phoneme: perception, identification and consciousness. Journal of Verbal Learning and Verbal Behavior, 12, 1973:246-257.

GANONG, W. F. (1978) A word advantage in phoneme boundary experiments. Journal of the Acoustical Society of America, 63, 1978, Supplement, S20.

PASSY, P. (1930) Une transcription ambiguë. Le Maître Phonétique, 3, 1930:24.